ARMOUR ENGINEER

AND ALUMNUS

OCTOBER
1939

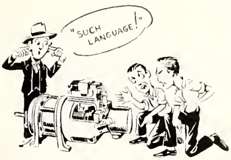
G-E Campus News

ENTERTAINING ROYALTY—BY PROXY

WHEN Great Britain's King and Queen visited the New York World's Fair on their international social call, 20 farmers were able to watch the royal pair as closely as if they were entertaining Their Majesties out on the farm. And the rural folk were 130 miles away from the Fair grounds.

This long-distance watching was made possible by G-E television engineers. Directed by C. A. Priest, Maine '25 and ex-Test man, radio engineer for General Electric, they were simply proving that television programs could sometimes be received at a far greater distance than the previously supposed limit of 40 to 50 miles.

For, instantly and clearly, while the King and Queen inspected the Fair, television reproduced complete details of their visit to the group—130 miles away, atop the Helderberg Hills near Schenectady. Not far from the scene of this experiment is General Electric's powerful new television station, W2XB, soon to go on the air.



TECHNICAL DOUBLE TALK

WALKING through one of General Electric's factory buildings, a visitor paused in front of two young men kneeling in front of an electric motor. He was mystified to hear, "Say, Bill, put a tac on that BTA, and after you've hooked up the pots and c-t's and plugged power, see if she still swings and hunts!"

All of which made as much sense to the visitor as "gate," "jive," "alligator," and similar swing-music terms mean to a symphony conductor. Translated, the young man was merely asking his co-worker to connect certain instruments to the motor, turn on the power, and notice whether the motor ran smoothly.

Few of the graduate engineers selected by General Electric for its Test Course are familiar with this Test man's jargon when they arrive. But after a few days in the shops the new man, too, is rattling away in the technical double talk as expertly as his elders.

TRAVELING HOTEL

NEXT Spring, when a hotel-on-wheels rolls into Bombay, India, some of the citizenry may have grave doubts about their sanity. Or they may blame the blazing tropical sun. They'll be wrong. Lawrence Thaw's trans-Asiatic motorcade will be completing a 14,000-mile safari from Paris.

Quite obviously, such things as 14,000-mile trips require quite a bit more than *savoir-faire* and an adventuresome spirit. Preparation, and plenty of it, was required by Mr. Thaw. This brought into the picture—both directly and indirectly—G-E engineers.

The four mobile units of the motorcade boast of the latest G-E two-way radio, for maintaining contact between the various vehicles throughout the journey. During tests two of the units maintained contact when as far as 200 miles apart. Air conditioned throughout, the deluxe trailer contains all the appliances and equipment normally found in a modern home—from tiled bath and indirect lighting to an array of electric appliances.

GENERAL ELECTRIC

90-181C

Paints by ARMSTRONG *for the* SNOW CRUISER—

Spraying the final coat of ARMSTRONG Paint on The Antarctic Snow Cruiser is pictured above. Thus again the ARMSTRONG Laboratories have come through on schedule to meet the exacting requirements for finishes that must perform the unusual in service. ARMSTRONG'S complete and diversified line of Maintenance and Industrial paint products is supplemented by a laboratory service right here in Chicago which engineers can rely upon to solve any painting or finishing program. A phone call will bring you expert advice. No obligation.

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Contributors

■ MICHAEL J. CORRIGAN, Fire Commissioner of Chicago, has the distinction of commanding one of the most efficient fire departments in the world. As a member of the department for more than forty-six years, he has had much to do with its present standing. He was appointed to the department in 1895, promoted successively to the grades of Lieutenant, Captain, and Chief of Battalion; became Assistant Fire Marshal in 1921; Deputy Chief Marshal in 1927; and Chief Marshal later in the same year. He became Fire Commissioner in 1937. During his steady progression through all ranks, Commissioner Corrigan has been honored by the award of the Lambert Tree Medal, first in 1917, and again in 1927.

■ FRANKLIN H. FOWLER delivered the address at the forty-third commencement of Armour Institute of Technology. It is printed in this issue. Mr. Fowler was graduated from the United States Naval Academy, and from 1909 to 1913 served as Midshipman and Ensign in the United States Navy. He resigned in March, 1913, and entered upon a business career with the American Bridge Company, at Gary, Indiana. Since 1932 he has been President and General Manager of Foote Brothers Gear and Machine Corporation. He is also President and General Manager of Bates Manufacturing Company, of Joliet, Illinois. Mr. Fowler served as Lieutenant Commander in the United States Navy during the World War.

■ B. C. HEACOCK began his business experience as a junior clerk in a bank in Kansas; later he held several positions, including junior membership in a firm of certified public accountants in Detroit. In 1919 he joined the C. L. Best Tractor Company of San Leandro, California, as auditor, afterward becoming successively credit manager, purchasing agent, and parts and service manager. When the Best Company and the Holt Manufacturing Company of Stockton, California, joined to form the Caterpillar Tractor Company, Mr. Heacock was named Secretary. Later he was elected First Vice President, and in June, 1930, at the age of forty-one, he was chosen President. He is Chairman of the Board of Directors of the Illinois Manufacturers' Association, and Chairman of the Manufactures Committee of the United States Chamber of Commerce.

■ A. WALCHER, Vice President of American Steel Foundries, is in charge of the operations of three large plants manufacturing steel castings for railway freight cars, a malleable-castings shop, and a spring and forgings plant. He is a practical foundry and forgings man, having come up through the ranks and having served as Works Manager for many years. Mr. Walcher has been Vice President since 1929.

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INVENTOR AND BUSINESS MAN

THE STORY OF JOSEPH S. DUNCAN

GREAT businesses have become possible because American inventors have developed machinery to produce quickly and economically things that we want to buy. A manufacturing industry, however, involves more than a factory. It is a complex organism whose functions include many things besides the actual processes which change raw material into finished goods. The office is essential, just as the shop is essential.

Not only in manufacturing, but also in many other modern activities, adequate control, follow-up, and record require almost endless repetition of actions which might become unbearably monotonous, and which by their very monotony are subject to error. The same names are written week after week on time cards, on payroll sheets, on Social Security reports. The same names and addresses are written on catalogs, on letters, on bills. In every public utility company an identically printed and addressed bill is sent to each customer every month. In every insurance company a premium notice is sent at regular intervals to every policyholder.

Today business does these things rapidly, economically, accurately because more than fifty years ago in Sioux City, Iowa, when Joseph S. Duncan was working in the office of a milling company, he had the task of sending out bids for grain to the farmers who supplied the mill, and quotations on flour to its customers. He did not like it. The laborious

The first Addressograph was a series of rubber stamps on an endless chain. An address was printed and the next stamp advanced to printing position each time the plunger was pushed down.

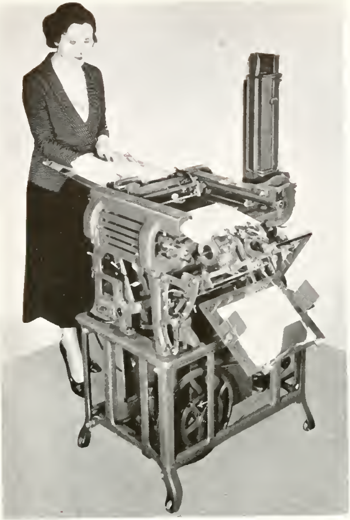
task of addressing post cards and envelopes to long lists of names seemed to him to be unnecessary drudgery, and he felt that it could be and should be done by mechanical means.

At the moment, Mr. Duncan did not follow up the idea, because he decided to sell out his milling interests and to buy a half-interest in a bank in South Dakota. After a year or more, he disposed of his share in the bank, and returned to Sioux City, where again the question of automatic addressing interested him, this time also in a milling company whose vice-president was an old friend of Mr. Duncan. Letters were written to many firms making office appliances, but no suitable machine was discovered. Mr. Duncan's friend said, "Why don't you build one yourself?" The answer was, "I certainly could," and that answer may be considered as the beginning of a great business, and as a promise of increased efficiency to many businesses.

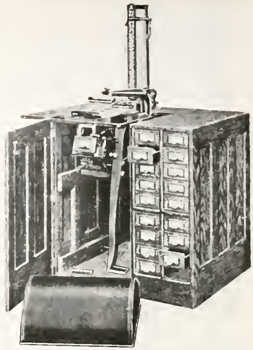
To Joseph Duncan there was nothing startling in the thought that he, already with considerable experience in the business field, should undertake the design of mechanical devices, —apparently quite a different kind of activity. He had an inherent taste for invention, which had already shown itself. He still chuckles when he tells that when he was a very young man he was operating an old-fashioned water-power sawmill. Wild ducks would often come and settle on the mill pond, just when his duties with the log and the saw made it impossible for him to concentrate on what he was longing to attend to,—the ducks and his shotgun. The problem was solved neatly by devising a way to shut off the water-power automatically just before the saw reached the end of the log.

The addressing problem was given careful thought, and a first rather crude design was developed, comprising a wooden drum with rubber stamps attached. After an impression was made from one stamp the drum revolved automatically until the next was in position. The device worked, but it did not satisfy the young inventor. The drum did not carry enough stamps; if a stamp no longer needed were removed, it left a blank space; if a new stamp were added, it could not be put in its proper alphabetical place.

Further study developed the thought that the addresses might be arranged on an endless chain, each link being detachable. A rough model embodying this design was completed after about a month's work, during which a large range in the Duncan kitchen served as a workbench. Sioux City friends of the inventor were not all of the same mind about the possibilities of the device, but he received enough encouragement so that he decided to go to Chicago to arrange for its commercial development. There, in 1893, arrangements were made for producing first a model machine and then twenty-five of the devices for sale. While the model was being built, it was decided to eliminate the use of rubber stamps, and substitute metal holders, each holding two lines or three lines of rubber type, and designed for insertion as a link of the chain. Most of these machines were sold, but Duncan believed that the device should be de-



Above. The machine produces a complete letter, dated, addressed, and signed, at a rate of 2,000 per hour.



Right. Early form Addressograph and filing cabinet. Note pedal operation.

veloped in a larger size, and in 1894 he completed a new model and let a contract for 100 machines. This new machine was provided with a foot lever, so that the operator's hands were free to feed the envelopes into addressing position. Its performance was decidedly satisfactory.

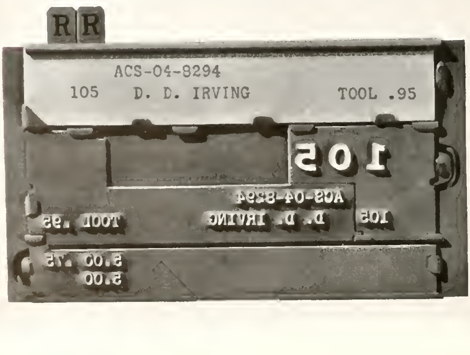
Now the business began to speed up. Carson Pirie Scott and Company placed an order for a machine and 5000 addresses. J. B. Hall, who had had extensive experience in specialty manufacturing, joined Mr. Duncan as a partner, and demonstrated the machine in Milwaukee and New York. Among the prominent men that he interviewed was J. P. Morgan the elder who said that there was a field for such a machine, if those back of it would develop it properly to meet the needs of the business world.

That is exactly what Mr. Duncan and his increasing number of associates did. They continued to improve the Addressograph, not only to meet the needs of the time but to keep pace with the ever changing requirements of business. A new process for making rubber type was devised; later came a special design of type with a soft face and harder body; improvements were made in the type-holders. Rubber type were subject to deterioration, and ultimately they gave way to embossed metal plates. The Graphotype was invented, to emboss the lettering on these plates.

As the number of users increased they saw many ways in which the Addressograph could be adapted to their businesses. Mr. Duncan developed attachments and modifications: a lister, an automatic feed, an automatic ejector, a cut-off to cause the machine to print only certain required portions of the embossed text.

Shortly after the beginning of the new century the vogue of the loose leaf spread over the country. Bound

The plate shown below is for payroll work.



books were discarded for card indexes or loose-leaf binders. Addressograph development kept pace by producing card-index plates, with the type and the index mounted together in a metal frame, so that notations of various kinds could be made in immediate proximity to the lettering to which they were related. This was a most important development, and greatly widened the field for the device.

The next demand was for speed. The hand-fed machines were fast enough for ordinary purposes, but to do a large volume of work in a short time the first automatic Addressograph was put on the market in 1910. Later, power-driven machines were produced.

During their long and active business lives Mr. Duncan and Mr. Hall directed the affairs of their vigorous and growing organization. Mr. Hall has died, and Mr. Duncan is enjoying his well-earned retirement from active business. In its modern forms, the machine which he invented and which he improved year after year, continues to develop as though it still felt the impetus of his inventive genius and his understanding of the needs of business.

One of the present models, starting with a roll of blank paper, prints a public-utility bill, or an insurance premium notice, or a tax bill on both sides; imprints each form in one to four positions with the name, address, and other data concerning each person; and dates, numbers, perforates and stacks the finished forms. All of these things are done in one continuous operation.

Another is a flat-bed machine which produces 2000 letters an hour, each dated, individually addressed and signed, and each an attractive duplication of actual typewriting.

Yet another is a machine which folds, wraps, seals, addresses, and sorts more than 8000 magazines or newspapers an hour.

Many of the machines are equipped with the automatic selector, which unerringly selects any desired group of plates for printing as they pass through the Addressograph.

Joseph Duncan set himself the task of designing a machine for rapid, economical, and accurate addressing of envelopes. He accomplished this and much more. His inventions had an important influence in direct mail advertising, which made possible the development of many great businesses. In innumerable cases, where information must be typed over and over again, the Addressograph has a natural field.

In factories, these machines prepare work coupons on which manufacturing instructions and wage rates are typed. Addressograph payroll methods are in use everywhere. In these, and in many other uses, the applications of Joseph Duncan's machines have gone far beyond what he or anyone else was likely to foresee in the nineties, when his answer to his friend's challenge, "Why don't you build one yourself?" was "I certainly could." He certainly did.

Scottish industry and tenacity; a natural aptitude for invention; a keen business sense and alertness to changing conditions; ability to organize and direct the work of associates and subordinates; perhaps something intangible in the atmosphere of our nation; all of these things have contributed to the successful, productive life of an inventor and business man, who in his own success has brought success to many other businesses, and relief from drudgery to multitudes of workers.

Below. These machines produce all the premium notices and receipts in the office of a great insurance company.

THE CHICAGO FIRE DEPARTMENT

By
MICHAEL J. CORRIGAN

THE progress of the world in industry and science since the turn of the century, together with the characteristic American apathy to persistent warnings to guard against the hazards of fire, have been sufficient challenge to fire department officials and equipment manufacturers to keep abreast of our high-geared rapidly changing conditions and to formulate plans to combat increasing numbers and types of fires and conflagrations, any one of which, if it goes beyond control, may become a major menace to our social and economic well being.

Not many years ago, nearly all buildings, even those of large size, were made of wood, or if they had masonry walls, wood was still used for the floor construction. The fire hazard was great and was fully recognized by firemen, who were ever fearful of the recurrence of a disaster like the great Chicago fire of 1871, and who had to carry on their work with equipment which was far better than the old bucket brigade, but still greatly inferior to what we have now. Nevertheless, as we reflect on the problems and review the records of the pioneer firemen, the conclusion is obvious that theirs was a task well and courageously done and that their splendid services constitute the foundation upon which a great fire department was built.

With the passing of horse drawn equipment went most of the drama of a fire department in action. Some of us remember the gallop of the horses, the skill of the driver through traffic snarls, the officer next to the driver ready to apply the hand emergency brake to check the speed, the smoke and steam pouring from the boiler, and the sparks flying as the engineer worked frantically to get up steam while he held on with one hand. For us, one of the thrills of city life is gone and another victory of the mechanical age is recorded.

For this loss, the compensation has been more than sufficient; today we have acquired the speed to arrive at the scene of the fire during those precious, all-important minutes that represent the difference between checking a fire in its incipiency and facing a blaze of large proportions. Further, business methods and modern manufacturing processes have enabled our fire departments to obtain specialized apparatus and equipment and to adopt modern tactics to combat the numerous chemical and manufacturing fires that were not prevalent decades ago.

The Bureau of Fire Control and Extinguishment is of course, the main arm of the Chicago Fire Department, with all other Bureaus and Divisions such as the Bureau of Fire Prevention, Bureau of Fire Instruction, Division of Fire Alarm and the Repair Shop functioning cooperatively to efficiently control and extinguish the many types of fires encountered.

At this juncture, it would be well to describe briefly the functions of the above-named bureaus and their methods of cooperation.

The Bureau of Fire Prevention inspects buildings, checks violations of fire prevention ordinances, orders corrections of violations and forwards to the respective fire districts the information necessary to prevent or to extinguish fires which might occur as a result of such violations; it also ed-

The Ruins of Chicago After the Fire of 1871

ucates the public in fire prevention and safety methods.

The Bureau of Fire Instruction receives and trains candidate firemen in the standard practices and procedures of fire extinguishment and conducts lectures, demonstrations, and drills for officers and members of the Fire Department on important subjects concerning the protection of life and property. During the current year the study of first aid and life saving was added to the curriculum of the school. A ten-week course was given by the director of the local chapter of the American Red Cross and over eight hundred of our officers and members

Stage of the Iroquois Theater

were graduated as first-aid instructors or received certificates for successfully completing the course. While this instruction period was in progress, we developed arm and leg splints which have since been approved by the American Medical Society. These splints are carried on our squad cars and ambulances as standard equipment.

The Fire Alarm Office receives and transmits all fire and emergency calls and dispatches the necessary personnel and equipment to the scenes as required. A day spent in this office would be particularly instructive to one interested in Fire Department activities and would show the diversified services which the Fire Department is

Pumpers at Work on Grain Elevator Fire

called upon to render, all of which must be anticipated to provide the proper equipment and its tactical application. Fundamentally, the fire alarm system provides a means by which a citizen who has knowledge of a fire transmits that knowledge to the Fire Alarm Office, which in turn dispatches to the scene proper personnel and equipment to deal with the situation. If, on his arrival at the fire, the officer in charge decides that more help is needed, the alarm system provides for sending additional manpower and equipment, some of it highly specialized, in response to each subsequent signal. Responses to extra alarms are carefully planned to provide almost automatically for any emergency.

To carry out the program of re-

Above. A modern sedan-type pumper.

Left. Old-style steam-operated horse-drawn pumper on duty at Iroquois theater fire.

sponse to alarms, the fire stations, as well as special companies and units, are strategically situated in order to provide maximum availability of apparatus, equipment, tools, implements, and man power.

The Repair Shop maintains all apparatus, tools, implements, and equipment in condition for immediate use.

All the above-named bureaus and divisions of the Fire Department must keep abreast of the times, and by study and research in their particular fields are ready to meet constantly changing manufacturing and chemical processes which add to the list of hazards to life and property.

Most people are more or less familiar with what may be called ordinary fire department apparatus and equipment, such as pumpers, ladder trucks, various sizes of fire bose, ropes, ladders, fire axes, and portable hand pumps. When a fire goes beyond ordinary size, and perhaps threatens to assume conflagration proportions, great pumping capacity is required to furnish many streams at high pressures and of large caliber, and the effective use of the varied equipment calls for close study of the tactical and strategical situation. In response to the special alarms sent in under these conditions come the modern large-capacity pumping units, aerial ladders, squad apparatus, fire boats, water towers, lighting equipment, various other special equipment, and, in recent practice, two-way radio

equipment. All of these have their own special and important functions.

Contrary to common belief that a fire department's greatest effort is expended during the progress of a large fire requiring the services of extra-alarm companies, too frequently our resources are sorely taxed while fighting fires of chemical origin, oil and electrical fires, and underground fires, especially those which are made more intense by compressed air during the construction period of tunnels and subways.

Each type of fire enumerated requires special tactical methods as well as special extinguishing agencies and special safety devices. For example, there are many chemicals which, if ignited, contaminate the immediate area with poisonous or disabling gases necessitating the use of self-contained oxygen gas masks of sufficient capacity to permit the wearer to reach the seat of the fire and extinguish it. Many of these chemical fires require an extinguishing agency other than water; for certain types of oil fires we use chemical extinguishers and more recently we have been developing a special fog nozzle which has proven definitely satisfactory and which merits more research and practical application to bring it to a higher peak of perfection.

The extinguishment of electrical fires requires a basic knowledge of electricity and of electrical appliances, and the danger attendant on exposed, hanging or submerged wiring, in order to prevent injuries and even fatalities. Fires in telephone exchanges, in electrical sub-stations furnishing light and power to entire communities, or to industrial power plants and kindred occupancies, while infrequent, require the utmost caution because of the extra-hazardous conditions and because the injudicious use of water or chemical extinguishers might result in an excessive loss out of proportion to the actual fire damage.

In addition to proper extinguishing devices many special tools and implements are necessary at fires so that forcible entrance may be made to advance to the seat of the fire. Special door openers, crowbars, battering rams, acetylene cutters, hooks, air compressors, stone-jacks, and other equipment come into use in accomplishing this end and also play a very important part in ventilating premises heavily charged with smoke, hot air, and gases.

Of the many opportunities presented to an executive branch of a municipality to be of service to the community, none is more productive of good will and more generally useful than that provided by a trained, well-equipped fire department speedily available for the preservation of life and limb. Its functions are not confined to fire fighting, but may be important in public catastrophes, drownings, street accidents, railroad wrecks, or the capsizing and sinking of water craft.

As a matter of classification of emergencies, which because of their nature do not require equipment used in the control and extinguishment of fire, but rather specialized equipment and especially trained personnel, we list the following, which require varying tactical procedures:

Collisions:

Two or more automobiles.
Automobiles and street cars.
Automobiles or street cars and railway trains.
Two or more street cars.
Elevated trains.
Automobiles or street cars with elevated trains running on the surface.
Railway trains.

Above. The Corrigan water tower. Below. Equipment for removing smoke from buildings.

Fireboat on duty at the worst fire of recent years in Chicago.

Derailment:
- Street cars.
- Elevated trains.
- Railway trains.

Collapse:
- Buildings.
- Gravity tanks.
- Other structures located above building roofs.

Water Craft Emergencies:
- Collisions between water craft.
- Capsizing or sinking of boats.
- Collapse of piers, water front foundations or wharves.

Miscellaneous Emergencies:
- Airplane accidents.
- Accidents with high voltage electric wires.
- Release of persons caught in elevators or between elevators and their enclosing shafts.
- Gas-filled areas or rooms, involving rescue of persons.
- Emergency service for electrical and ammonia refrigeration systems.
- Burns, cuts, fractures, shocks or gas cases requiring first aid measures, and transportation of accident victims.
- Accidents requiring the use of inhalators or the prone-pressure method of artificial respiration.
- Situations requiring light-wagon for illumination of rescue work.
- Sewer explosions or asphyxiation by sewer gas.
- Automobiles submerged with or without occupants.

One could go on indefinitely in the classification of such emergencies. I am firmly convinced that as scientific development progresses, we shall be constantly confronted by new emergencies engendered by its complexity. Most striking as an illustration is the handling, care and storage of recently developed volatile and flammable oils, and of hazardous gases and chemicals. We are constantly meeting emergencies that require the skilled use of technical data and of scientific and sensitive equipment and apparatus, such as self-contained and filter types of breathing apparatus, instruments that detect dangerous gases and deadly chemicals, all unknown to fire departments twenty-five years ago.

It may be asserted as an established truth that an accident or emergency may be the occasion for a fire department, in its stride, to render a great public service and to rightfully merit and receive the approval and acclaim of a thankful people, but by the same token delays, errors, inefficiency and ignorance manifested by unskilled personnel or occasioned by the use of inadequate or obsolete equipment or apparatus may, perhaps justly, bring down upon our heads criticism and censure. Excuses will be considered as of little weight, and the fact that grave emergencies have been contended with under difficult and unusual conditions will not be taken as excuse for ineffective performance.

It is essential that probable or possible emergencies in our communities be recognized, that the personnel of our department be trained to cope with these situations, and that the special tools, equipment and apparatus appropriate for this service be provided and kept in proper condition and available for immediate use.

The personnel using or operating these tools, equipment, and apparatus should be thoroughly familiar with their capabilities and limitations. They should know not only what to do and how to do it, but also what not to do. The latter is of prime importance, especially in emergencies involving flammable and explosive gases or deadly chemicals.

Earlier in this discussion, mention was made of the Repair Shop, as constituting one of the divisions of the Fire Department. Officially known as the Mechanical Division, it is engaged constantly in the production of new devices, some of them of highly special character, and in research tending toward more effective use of existing equipment. It is a proving ground, as well as a designing and manufacturing unit. In all of its functions, it has been interesting to note how frequently a suggestion, a hint, sometimes rather a vague idea, originating with some member of the staff, not necessarily with extended experience, has been developed by the technicians and engineers of the division to provide important new or improved weapons for fighting fire and other emergencies.

In brief summary, the Chicago Fire Department has a personnel of 2833 officers and men. For departmental supervisory and administrative purposes the city is divided into three bureaus and six divisions, and these divisions into 28 batallions. Fire stations number 141, and provide quarters for 184 companies, including two fire boats. The annual cost of operation and maintenance approximates eight million dollars, all of which accrues from general taxation. Our department averages 25,000 alarm responses annually, and our paid fire losses have an abnormally wide range as is evidenced by the fact that the 1935 loss was $3,712,000 and the 1929 loss was in excess of $16,000,000. The area of the city is 212 square miles and the most recent estimate of population is 3,450,000.

CHARACTER IN INDUSTRY

By

FRANKLIN H. FOWLER

THIS subject, Character in Industry, has as its basis the study of individuals, and I hope you will bear with me if a lot of the things I say sound to you like the most banal of platitudes, because, unfortunately, when you start to generalize about individuals, you have to use a certain number of platitudes.

To handle men or women, the first requisite is to recognize that there is no such thing as a class of working people; that there are classifications and types of work, but each person doing any type of work is an individual, and despite misanthropic preachings to the contrary, the individual with merit is sure to rise in the achievement and reward scales. I want to tell you that that is the most important lesson that anyone handling men has to learn, and any man who hasn't learned it ought not be handling men. The successful leader of men (and he will not be successful unless he is a leader, not a boss) has to study, first of all, each individual whose work comes under his supervision.

If you will look up the public leaders in science, in industry, in engineering, in religion, in statesmanship, in teaching, in commerce, in agriculture, and in law, you will be surprised to note that, regardless of early environment, these men have won their places through merit. As there are more people in the lower economic levels than in the upper, there are also more leaders who came up from these levels, but the percentage is about the same as the general relation of economic levels to each other. That is just as true today as it ever was in the days of our forefathers, and probably in the case of every man in this room, the individual at the head of his firm started at the bottom, or very close to the bottom.

Now, every one of those men has been preeminently a student of individuals, and the first study that the man undertook was of himself, and he undertook it very early in his career. He studied his own lacks and his own strengths, and he tried to correct his lacks and develop his strengths, so that it became almost a habit with him to discern the lacks and strengths of every man with whom he came in contact. The worst trait in men is the alibi habit, and the quicker each man overcomes this, the more successful is his self-study.

Probably the greatest quarrels that take place in industrial firms are between two men of different departments who fight over the manner of handling something for the company's good. That is nearly always true. They get vicious over it; they become personal; and yet both of them are not fighting directly for their own welfare, but for the welfare of the company. There is lack of cooperation. The test of how far a man can be entrusted to the supervision of others is the extent to which he is cooperating.

I want to emphasize several very broad qualifications that every executive must have—from working foreman to major executive. He must have strict and unquestionable honesty; a definite understanding of the art of imparting knowledge to others; a knowledge of human attributes; firmness and technical ability.

It may surprise you that I put technical ability last. So much has been said about the hard-boiled, dishonest foreman, superintendent, or other executive, that I wish to impress upon you that honesty in the executive capacity in industry is so common that almost never is a dishonest man found in these capacities. The greatest proof of this is that whenever dishonesty does appear it is headline NEWS with capital letters. These men not only do not steal or lie, but they have intellectual integrity. They tell facts; they don't try to cover up in their reports. When errors have been made, they go to their immediate superiors and report those errors, and do so quickly; they don't try to throw blame on others as they recognize that all alibis cause losses in time, as eventually somebody has to search out and learn the facts.

Many of the finest specialists in their particular lines will never become major or minor executives. This is largely because they have never learned to impart their knowledge and experience to others, and because they are seldom willing to admit that they can be in error.

To some extent, this ability to impart knowledge to others is born in a man, but it can be trained into some men provided they have the willingness to learn. I think that all of you who hope to be executives will agree with me that you probably have to spend an average of from one to two hours every day of your lives in the study of subjects outside your regular duties in an effort to improve yourselves in those subjects in which you know you are woefully lacking. Many examples of how small you are and how little you know come to your attention every day; and you know that the man who is not constantly improving himself is not fitting himself for a better job.

In a factory, mechanics, engineers, and other employees are constantly being observed by their supervisors to see whether they are imparting their experience and knowledge to others, whether they are cooperating with others, and also whether they are reporting their errors quickly instead of trying to cover them up.

When you hear a man state that he works hard, earns his pay, has been with the company for a long time, but that men who never could know as much as he does have been advanced over him, you are hearing the lone wolf speak, the man who won't lift a hand to do any more than just what he thinks, according to his standards, he is being paid for, to further the interests of either a fellow employee or his company. He is the fellow who is getting by, and will never be considered, regardless of his inherent ability, for selection as a foreman when the time comes, or, if a foreman, to a better position.

When you hear of a fellow who is proud of his company, his department, his associates and product, that fellow usually will go up. His educa-

tion and willingness to sacrifice leisure time in self-improvement will determine how far.

We have had to make a great many changes from time to time, sometimes through sickness or death and similar occurrences, particularly in the formative stages of our company some eight years ago. We had a real problem in our company; having some 26 foremen, we decided that we were going to have very definite control of our overhead, which very few companies do have. Now we have three general foremen and a superintendent in one factory; a superintendent and foreman in the other factory, and a vice-president in charge of manufacturing, who is also in charge of the engineering department, the order department, and other manufacturing departments. In making our choice among these 26 foremen, the qualities I have been describing here, more than technical skill, were the things that governed our selection. Some of the men who were passed over have greater technical skill than the men chosen for the jobs. We have made no changes since the initial change was made. These men have very, very thoroughly justified our judgment.

Now, I must speak a word on human attitudes, which is one of the attributes that we look for very definitely. A good executive realizes that every good man is working for the following reasons:

1. To provide food and shelter for himself and family.
2. To provide education for his children and more education for his wife and himself.
3. If not yet married, to make enough to get married on.
4. To provide for the rainy day.
5. To provide for luxuries and amusements.

The foreman must know which of these basic motives predominate in each of the men coming under his supervision. He knows that Number 1, (to provide food and shelter for himself and family), is common to all, or was prior to the present era. Now, unfortunately, many believe the good, old, long-bearded uncle will provide. Therefore, the foreman concentrates on studying Numbers 2, 3, 4 and 5, that is, the desire to provide education for the workman's children, himself and wife; desire to get married; providing for a rainy day; and providing for luxuries and amusements.

Where the foreman finds 2, 3, and 4 in predominance in a workman, that is, providing education for children, self and wife, or future wife, and providing for a rainy day, there is a good man, and if his technical ability is basically sound, that man is valuable.

Recognizing these common basic traits, the foreman sets about to really understand his men. He usually finds that his best men are married men, and happily married men. They are unselfish in their devotion to their families and are well cared for by their wives. The man with a nagging or extravagant wife seldom is a good man in the shop. Also, the man who spends his earnings foolishly and is not saving will seldom be a satisfactory employee.

The foreman must learn all of this about each man he supervises, and, incidentally, the man that the foreman reports to should know all about the foreman, too.

Henry Ford was criticised very strongly at one time. I remember it very well. We were all paying the best toolmakers $2.50 a day for a ten-hour day, and the best ordinary machine operators received between eighteen and twenty-one cents an hour; ordinary drill press hands got around seventeen cents an hour, and truckers, sweepers, etc., got thirteen and fourteen cents an hour. At that time, 1914, Mr. Ford sent a news release to all the newspapers saying that he was going to pay a minimum wage of $5.00 a day. The factory in which I was foreman at that time employed about 500 men, and the morning following that announcement, 16 reported for duty. Even most of the foremen had gone. Of course, Ford couldn't hire all the people who went to Detroit, because every train that came to Detroit was filled. But he did cause the wages paid in the United States to be raised over night, and when you hear Henry Ford damned by the man who tries to do business on his own terms with Henry Ford and Henry Ford won't do it that way, and by the politicians who have never been able to get one bit of graft out of Ford, just remember that all of the isms and all of the theorists and all of the legislators have never done as much for the working man as Henry Ford.

He did make one mistake. He tried to get too far into the personal history of his employees. He demanded to know what a man was doing with his earnings, and he made a whole lot of men very angry, and some of these men came back to work for me for that reason, but by that time we had raised our wages to make this possible.

Another thing that is very important to know is the racial characteristics and background of each man. Here in Chicago is probably the greatest melting pot that exists in the United States. We have Swedes, Germans, Poles and Czechoslovakians. I would say that those are our greatest source of factory labor. Then we have Italians, the Negro and the American whose progenitors have been in this country for five or six generations, and they appear in the factory in just about that order.

Now if you are going to understand some of the isms that are in a man's system, you should know something about the history of his country. Let us take Poland. Poland is a nation that since the thirteenth century has been under tyrannical rule, probably under more severe tyranny than has been suffered by any other people in the world except the Jews. Now the average first-generation Pole doesn't believe much in anything. He always wonders what the catch is.

Your Czechoslovakian is of three general types. You have the Slovakian, the Moravian and the Bohemian. The Bohemian has a great many of the characteristics of the German. He is exact; he has a great love of exactness, a love of quality. In addition to that, he is probably on a par with the Bavarian in Germany in his great love of music and beauty.

The Moravian is halfway between the Slovakian and the Bohemian; and the Slovakian has almost the same general characteristics as the Pole. Generally, he has always been wretchedly poor.

I am just mentioning these little examples to give you a general background. Every worthwhile leader (not the exploiter) wants to help the immigrant (those born abroad) become an owner of Democracy, as so aptly put recently, and not a boarder on Democracy.

If a man has a background such as mentioned above, the lives of his children, the first generation in this country, are going to be colored by that background. The second or third generation will lose these characteristics entirely. But you have these conditions to think about all the time, and you must be sympathetic with your men. For these reasons I believe that every man in an executive capacity should know a lot about the folklore and history of every race that he is supervising.

The real test of an executive is—can he be fair? A lot of people handling labor have an idea that being fair is leaning over backwards a little bit towards a man. That isn't being fair, even though it is good politics for the politician. It certainly isn't being fair to his fellow employees, and it isn't being fair to the owners of the company. They

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INVESTMENT IN COOPERATIVE EDUCATION

By
A. WALCHER

As our industrial organizations become more complex because of the increased size of manufacturing establishments, as their scope is materially broadened because of the many additional functions of industrial management, and as the operation of the plants becomes more technical because of the more involved manufacturing processes and more intricate mechanical units, it naturally follows that industry must depend more and more upon men thoroughly trained in the basic fields of knowledge and equipped with the mental ability to comprehend and cope with these larger problems of management. Hence the increasing demand for college graduates for supervisory, technical, and executive positions in industry. However, college training in itself is not always the answer and does not always result in meeting the requirements of industry.

For many years there has been the conception among industrialists that this college training, particularly in engineering and other technical fields, would be made more valuable and become more readily effective in industry, if it were more definitely coordinated with and related to the actual problems and production practices of industry. While these industrial methods can be somewhat simulated in colleges, through the establishment of actual production units, this is rather impractical and becomes a very costly undertaking if the equipment and methods are to be kept up to date, particularly in a period of such rapid technological changes as are taking place today.

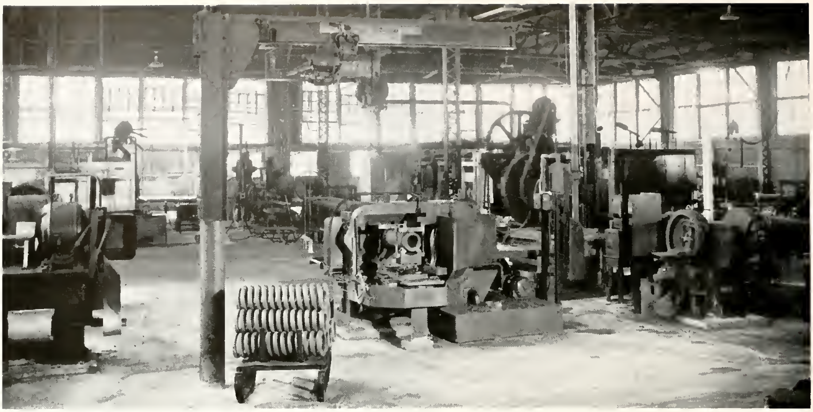
To men in industry the solution of this problem seems to lie in the direction of taking the college man into the shop for this practical side of education, rather than taking the shop to the college. This same line of thinking seems also to be in the minds of educators, as evidenced by the growing tendency toward cooperative training.

A plan of cooperative training, designed to give the student alternately several months in college followed by several months in the shop, doing actual work on the product or on the engineering and designing problems connected with the product, seems definitely to meet the requirements of industry in producing both a well-trained and an industrially minded personnel.

Such training serves a dual purpose, benefiting not only the student but at the same time being of great help to industry.

The student has the advantage, not only of obtaining a better perspective of his training and of industry, thus enabling him to coordinate his thinking while pursuing his studies, but also has the advantage of having an opportunity to apply the principles and theories to the practical problems in industry during his training period. His college work is made more practical by his contact with actual production problems, and his shop work is made more intelligent by the application of his college training, both working together concurrently rather than independently and separated as to time. While he is attending college he is also gradually becoming acquainted with the organization, methods, and practices actually used in operating a business establishment, and is becoming adjusted to an industrial environment, all of which tends to make him more practical.

From industry's standpoint there is of course the investment of time, money, and effort in these students in properly supervising their shop training, providing for actual experience in the various processes, facilities, and functions of that enterprise, and



Above. Part of spring shop, Hammond Works, American Steel Foundries.

Below. Armour cooperative student at work on engine lathe.

scheduling their progress through the shop in such a way that the experience gained will be of the utmost educational value and not represent merely a job to provide the necessary funds for an education. All this is however an investment that will yield a return to industry in the form of a better trained personnel. Whatever represents an advantage to the student in bettering his education, naturally represents also an advantage to the organization that will eventually make use of the student.

Speaking now from actual experience with the Armour cooperative training plan, our observations are of necessity limited to the period during which the training has been given. The plan has been in effect only three and one-half years and none of the students have graduated and reached the stage of assimilation into the supervisory organization, which of course is the crux of the matter. Notwithstanding this limited experience, we have come far enough to feel confident that some very fine additions to the supervisory and management personnel will be the result of this type of training.

The selection of the students was very carefully made but, as with almost any plan, there have been some casualties—students who have left the course either because of their inability to handle the scholastic work, or because the production work in the shop became too heavy, but these have been relatively few.

For the shop work a definite schedule has been worked out giving the

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PROGRESS OF A PIONEER THE TRACK-TYPE TRACTOR

By

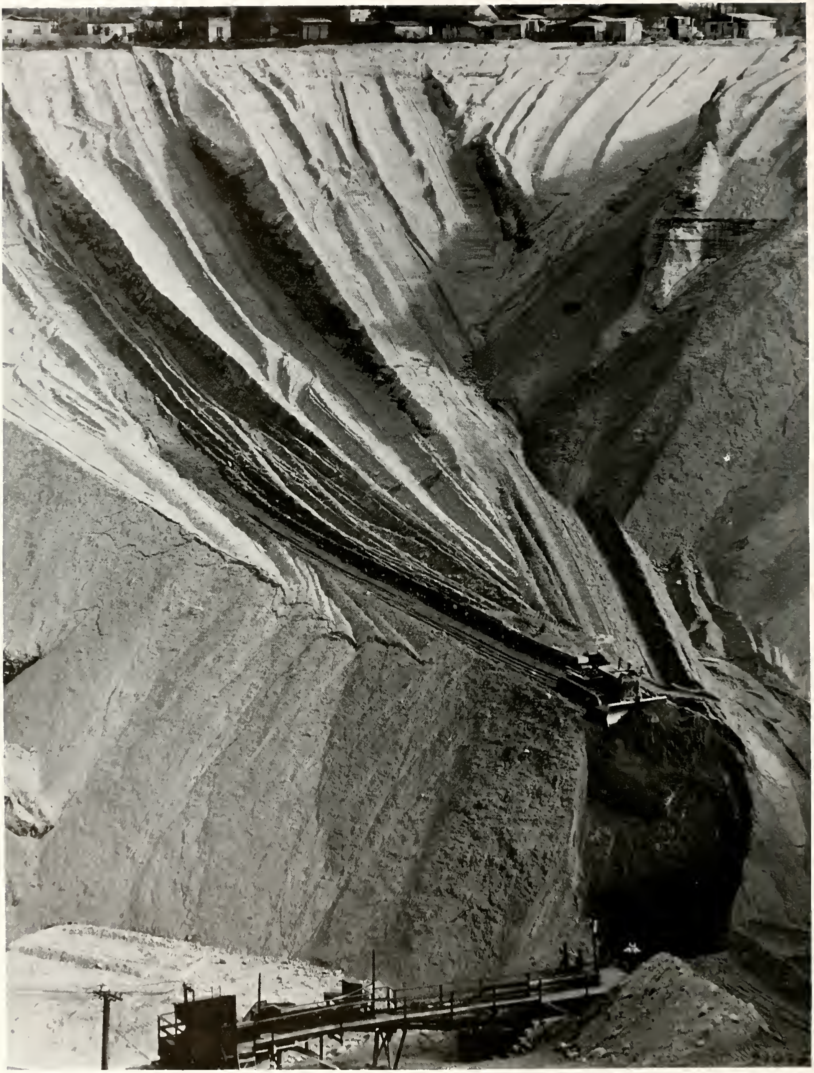
B. C. HEACOCK

A fleet of caterpillar diesel tractors, with bulldozers, scrapers, and rippers working on a sixty-five-foot cut on a United States highway project in Oregon.

IT was in 1904 that the Society of Automotive Engineers was organized; that the first Vanderbilt Cup Race was held; that the first Maxwell, Reo, Stoddard-Dayton, and Studebaker automobiles appeared on the market; that Prest-O-Lite headlights were first offered. And in that year the track-type tractor was first produced.

The new machine traveled across the softest footing without miring—making it possible and practicable to cultivate economically some of the most fertile farm land on the face of this earth. Today an enormous part of the earth's acreage is in cultivation only because of track-type tractors. Fine homes are on this otherwise nonproductive land; the retired, the working, and the growing generation of people live on it, and from this salvaged land move foods and fabrics to the empty stomachs and bare backs of hundreds of thousands of people.

Construction was commenced on the Los Angeles Aqueduct shortly after the first of these machines proved its worth. The contractors had started to use mules to haul equip-



Left. Caterpillar diesel equipment with Le Tourneau bulldozers pushing sand, rock and gravel to bottom of pit, where conveyor belts take it to crusher and grader.

Right. Top. A 1908 model gasoline caterpillar tractor.

Right. Middle. A tractor pulling a weeder. It covers twenty-two acres per hour.

Right. Bottom. Tractors rebuilding and realigning state highway in California. Very rocky, with steep grades.

The Jackrabbit Trail in Riverside county, California. The project has ten caterpillar diesels, with La Tourneau scrapers, bulldozers, rippers, and tampers.

ment and supplies across the Mohave desert to Owens Lake, but the faithful mules could haul little pay load after enough food and water had been placed aboard the freight wagons to maintain the animals on the torrid trip across the desert. So the builders turned to the new tractor that was now being offered with a gasoline engine instead of the original steam power plant. Good water in abundance was made available to a large and rapidly growing population at an earlier date.

Word of the new machine slowly spread to other fields. It was a great boon in the rice fields where the water buffalo and the coolie had been the only sources of power since the dawn of history. Here was a machine that could pull giant tools through the mud—that could plow and plant and harvest under the most adverse conditions—because it put less weight on the ground per square inch than a man does with his foot.

The first practical track-type tractor was built by Benjamin Holt and proved its worth in a trial run on the soft delta soil of Roberts Island, California, early in 1905. This machine, steam-powered, was a cumbersome affair but in principle and performance it was the long-awaited answer to a traction problem that its huge round-wheeled predecessors had failed to solve.

Only a year later the gasoline-powered track-type tractor was introduced, and this development was only the first of a series of refinements and improvements that has marked the progress of the industry since its humble beginnings.

The third major power step came in the fall of 1931 when Caterpillar Tractor Co., successor to The Holt Manufacturing Company and the C. L. Best Tractor Co., pioneer makers of track-type tractors and harvesting machinery, produced the first diesel track-type tractor. The amazing fuel economy and lugging power of this modern prime mover has resulted in a decided preference for it, according to universal reports from the industry.

But to go back to the beginning—one of the first agricultural tractors went to the rice fields of Louisiana—others went to rice ranches in California and these track-type machines have worked such miracles in the rice fields that this great staple crop can be, and is being, produced in American fields, under American standards of wages and living conditions, is being shipped across the Pacific Ocean and is being sold in China and Japan in direct competition with rice that has been produced in those countries by coolie labor that receives only a few cents a day.

In no field has the influence of these machines been more profound than in that of road building. They could carve new roads through swamps, across deserts, over mountains and boundless stretches of prairie. They could work in wet ditches or on newly made fill. They could climb steep grades and cling to treacherous hillsides. They could go and pull big loads wherever roads were to be built. The track-type tractor not only successfully accomplished construction feats that had never been tried before, but it powered the hitherto costly job of road-building at great savings.

What contributions have good roads made to economic and social progress? Answers to this question stagger one's intellect. For instance, where would the great automotive industry have been without them? This may be a case of asking which came

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THE AVIATION INDUSTRY A FIELD FOR ENGINEERS A FACTOR IN NATIONAL DEFENSE

A COMMUNICATION from Lieutenant Colonel Joseph H. Davidson, Air Officer of the Sixth Corps Area, points out that the engineering student who hopes to find his future occupation in the rapidly growing aviation industry may do well to plan a program which will include successively service in the flying cadets, a reserve commission, active duty with the Air Corps, a regular army commission, study at the Air Corps Engineering School, and assignment to the Material Division.

Application for appointment as a flying cadet should be made by writing to the Commanding General, Headquarters Sixth Corps Area, United States Post Office Building, Chicago. Engineering graduates, or engineering students who have finished at least two years of their college courses, are exempt from academic examination; they must be in good health, and the physical examination is especially rigorous in its investigation of eyes and of nervous system.

A new class of flying cadets is organized every six weeks. A cadet receives nine months of flying training at selected civilian fields, or at Randolph or Kelly Field. Completion of the course brings the student his wings, a commission in the Air Reserve, and extended active duty with a tactical unit, with the opportunity to obtain a commission in the regular army. After further training with the tactical unit, the young officer may apply for detail as a student in the Engineering School.

Flying cadets are paid $75 a month, plus ration allowances and clothing. As a second lieutenant, the flyer is paid $205.50 a month, and a $40 quarters allowance if the government is unable to furnish quarters. As a first lieutenant the flying officer receives $298.50 a month, with a quarters allowance of $60.

Upon completing his three-year tour of active duty, the officer receives a bonus of $500 if he returns to civil life.

Located at Wright Field, near Dayton, Ohio (the home of the Wright brothers) are the laboratories of the Air Corps Materiel Division, representing an investment of $10-000,000 in the world's most modern aeronautical engineering equipment. The current plans for large expansion of the Air Force will create a need for additional engineer officers who will find place at Wright Field, together with some of the country's foremost civilian aeronautical engineers, on the staff of the laboratories. Wright Field, dedicated in 1927, comprises 746 acres and is occupied by the laboratories and by a 520-acre field for actual flight testing. The adjoining Patterson Field, occupying 3,800 acres is assigned to the use of the Fairfield Air Depot.

The Materiel Division also has supervision over three other depots in the United States, at San Antonio, Texas; Middletown, Pennsylvania; and Sacramento, California; and three more, one each in Panama, Hawaii and the Philippine Islands. Under the direction of Brigadier General George H. Brett, Assistant Chief of the Air Corps, the Materiel Division is charged with having in readiness for immediate production and service the most advanced types of aircraft, engines, armament, and other equipment, procuring this equipment in necessary amount to issue to the tactical services of the Air Corps, and maintaining it throughout its service life.

The Materiel Division also supervises three procurement districts and six industrial planning districts, to which the Air Corps looks for mass production of fighting aircraft in the event of an emergency.

History of the Materiel Division dates back to the establishment, in 1917, under the Signal Corps, of a laboratory for aeronautical experiment, testing, and research in order to provide adequate aviation equipment for war purposes. The laboratory was at McCook field near Dayton.

By 1919 McCook Field had 254 acres, with a wind tunnel and sixty-nine buildings, including hangars, shops, laboratories, offices and a hospital. In 1926 the Air Service became the Air Corps and the engineering division became the Materiel Division. McCook Field proving too small, the laboratories were moved to the present location, Wright Field, in 1927.

During the twenty odd years of its existence, the Materiel Division has figured directly or indirectly in virtually all aircraft developments, commercial as well as military. In many instances, its contributions have been of major importance, definitely influencing aircraft operation or performance.

The present high-powered air-cooled engine is the direct result of intensive study in the cooling of

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I WAS THINKING

By

JAMES C. PEEBLES

THEY were long, long thoughts that I was thinking the other day; thoughts that went back to a sunny Saturday afternoon in the first summer of the century. Fresh from the rippling plains of Iowa where the fields were fair with waving wheat, and gallant with regiments of tasseled corn, I had come to the big city to study engineering. At the moment I was walking east on 33rd Street, approaching State Street. With the grind and groan of steel on steel a cable car jerked to a stop, and then with a succession of more violent jerks, was on its way again. Determined to discover what made it go I examined the track, while a newsy on the corner, pert with the wisdom of the city streets, yelled, "Drop a nickel in the slot and see the cable run."

But my chief interest that day was Michigan Avenue, which, I had been told, was the show street of the city. The boulevard was crowded that afternoon, chiefly with elaborate private carriages drawn by snappy teams which, thanks to my country training, I could appreciate thoroughly. But the two stiff-backed men on the box, wearing their importance like a garment, seemed to me just a trifle silly. Almost all the traffic was going south and it seemed that some important event must be taking place.

Suddenly from the north came the sound of clanging hoof and horn, and soon a brilliantly decorated tally-ho appeared, drawn by four beautiful bays and crowded with men and women. Across the side of the vehicle appeared a huge banner with the words "American Derby, Washington Park." Time for inspection of this race-going crowd was brief, but I saw floor-length skirts, hour-glass figures, wide sailor hats, flowing veils, parasols; shoes with pointed toes of incredible length, tight fitting trousers, three-inch collars, derby hats. The "mauve decade" had passed into history just a few months before, the pink decade that had tried so hard to be purple. But this was a purple moment, when Chicago society folks went to the derby. A day to be recorded in rubrics in the personal history of the youngster from Iowa.

Soon the race crowd thinned out, and I began to observe the street more closely. Standing at the corner of 33rd Street, I saw a massive brown-stone house to the north, a distinguished gray-stone to the south. Later I learned that these were the homes of two prominent industrialists of early Chicago, a well-known meat packer and a prominent brewer. As they stood there, massive and imposing, they seemed somehow to typify the *I will* spirit that had built Chicago. For the avenue they were a brown-stone and a gray-stone, for those who rode by in carriages they meant meat packing and brewing, for the man who walked they were simply a ham sandwich and a stein.

Many times in the months that followed I observed those two homes. In the gray-stone life seemed to move quietly, endowed with sufficient leisure to make for gracious living. But in the brown-stone life was more active and gay. Many a brilliant party was held there and often during a stroll along the boulevard I have heard the strains of the "Blue Danube" or the "Merry Widow" coming from the third-floor ball-room. Those were horse-and-buggy days, content to move at a leisurely pace, and affording time for the practice of the fine art of living.

In the meantime subtle changes were taking place along the avenue. For some time strange contraptions had been appearing on the street, vehicles that looked like a carriage but ran without horses, sometimes. They were evil-smelling machines too, so much so that residents and pedestrians alike were often disturbed by a certain nostalgia for the faintly barnyard essence that, despite the efforts of white-wings and sparrows, distinguished the avenue of an earlier day. Also, these new devices seemed to suffer from all the ills that untried machinery is heir to, plus chronic foot trouble. To keep their internal organs in working order required the combined efforts of chemist, engineer, and prestidigitator. But no art, either black or white, could keep the tires inflated. One day one of these self-movers, so called, while crossing State Street slowly settled down on the car tracks with a long-drawn sigh of exhaustion, all four tires as flat as the car wheels that had ground the rails to a ragged edge.

Back on the boulevard things were going badly with the brown-stone and the gray-stone. Life in the latter withdrew more and more from its surroundings, content to be limited by its own substantial walls. Finally came the well-remembered day when I discovered that the brown-stone was empty. Its windows, like vacant and unseeing eyes, stared out at the street, as it brooded over the murky march of milling motors.

After a period of idleness the brownstone became once more a scene of activity. A hospital staff moved in and was soon doing a thriving business. But its patients were the cars in the street and it was known as a motor club. Its business was to render mechanical aid to the cars and legal services to the owners. With cars that were still far from perfect and drivers with little or no experience, there was ample need for both.

Soon my favorite corner received another blow, when wreckers appeared at the gray-stone and began to take it down, stone by stone. In a short time only a patch of rubble was left to mark the spot where one of the finest residences on the avenue had stood. Already the horse had disappeared from the street, which now became a highway, not a place of residence. The horse, bred in Kentucky and fed on corn and oats from Iowa, had been driven out by the motor car, bred in Detroit and fed on gasoline from Oklahoma. So a filling station later appeared on the site of the gray-stone, and the end of an era was definitely at hand.

Later the motor club out-grew even the spacious rooms of the brownstone, and moved down town to larger quarters. Other business organizations occupied the house from time to time, usually for short intervals only. At last it was vacant for a long time, and seemed to have settled down to desuetude, dust, and dejection. With little left save to dream of its departed glories, it wrapped the drapery of its cobwebs about it and calmly awaited the wreckers.

But obituary notices for the brownstone were premature. Recently it has been the scene of tremendous activity, as work went ahead in a complete renovation of the old house. It will be a home again, not a place of business; a home for a group of young men pursuing graduate studies in engineering. For nearly forty years, as man and boy, I have known the brown-stone. and I rejoice today in its renaissance. All the world admires a come-back because it requires character and courage. There is character in that old house, it seems to me, and courage too. There are sermons that those old stones could preach, sermons from which the present occupants may occasionally catch a word. So the brown-stone lives again and I wish it many years of usefulness.

AN IMPORTANT NEW BOOK

ATOMS IN ACTION: The World of Creative Physics. By George Russell Harrison, William Morrow & Company, New York. $3.50.

"No book such as this could have been written before, . . ." writes Dr. Arthur H. Compton. The book is full of news. It is not a textbook, nor is it a learned treatise which has been thought out and written in abstruse terms and then translated into colloquial language. It is a fresh, stimulating report of things that concern everyone. It could not have been written a year ago; today's news could not have been written yesterday.

No man can nowadays read everything that would have value for him. In the field of the physical sciences, even the most gifted can not hope to be fully informed outside the field in which he has chosen to specialize. For those of us whose work is not in the field of pure research nor in the applications of research to design, this book, with its review of important parts of the world of creative physics, is useful and interesting. It does not define a mesotron, but it gives us a suggestion of the complexity of the system within the atom. It does not discuss fundamental theories of aerodynamics, but it tells the story of the airplane, the autogyro, and the helicopter. Acoustics, optics, agriculture, medicine, the radio, television, refrigeration, photography are discussed. The author does not waste his energy and our patience by continual demands that we bow down before the wonders of science. He writes simply and convincingly; our admiration for the achievements that he reports comes from the facts themselves, and not from the author's panegyrics.

Dr. Harrison is a professor in the department of physics and Director of the Research Laboratory of Experimental Physics at the Massachusetts Institute of Technology. The writing of ATOMS IN ACTION was undertaken at the instance of the American Institute of Physics, the central organization of the societies of American physicists. The author acknowledges the hospitality extended him by many laboratories of pure and applied research, and the receipt of material, some of it not hitherto published, from an imposing list of physicists, chemists, and engineers.

NEW TRUSTEES

THOMAS DREVER, President of the American Steel Company, was born in Edinburg, Scotland, and began his business career there in 1905 as a public accountant. He came to New York in the same year and did accounting work there and in Boston for five years. In 1910 he joined the American Steel Foundries as comptroller, and subsequently served as Secretary and Treasurer and as Vice President and Treasurer before his election to the presidency last January. He is a Director and Member of the Executive Committee. From 1924 to 1929 Mr. Drever was President of The Wahl Company. He is now a Director of The Wahl Company, Chairman of the Board of Directors of the Griffin Wheel Company, Director and Member of the Executive and Finance Committees of the General Steel Castings Corporation, Member of the Executive Committee and Governing Board of the Railway Business Association, and Director of the Economic Club of Chicago.

Mr. Drever is a resident of Glencoe. He is active in civic affairs there and in Chicago, and is a member of the Chicago, Tavern, and Glen View Clubs.

JOHN W. FRANK, President of the Ilg Electric Ventilating Company, was born in Natchez, Mississippi. He attended Phillips Exeter Academy and the Massachusetts Institute of Technology, where he received the degree of Bachelor of Science in Electrical Engineering in 1907. Immediately after his graduation he was employed by the Commonwealth Edison Company, and remained with that organization for three years. In 1910 Mr. Frank joined the staff of the Ilg Electric Ventilating Company as a sales engineer. He became Vice President and Assistant General Manager in 1912, and was elected President and General Manager in 1928.

Mr. Frank lives in Hubbard Woods. He is a member of the American Society of Heating and Ventilating Engineers, the North Shore Art League, the Business Men's Art Club, the Lake Shore Country Club, and the Tavern Club. His favorite recreation is water-color painting.

As we go to press, we learn that the Board of Trustees has elected FRANKLIN M. De BEERS and LOUIS S. HARDIN to membership. More extended notice will appear in the December issue.

RALPH H. NORTON, President of the Acme Steel Company, was born in Chicago and attended the Chicago Normal Training School and the University of Chicago. He joined the staff of Acme Steel in 1906, and became President in 1923.

Mr. Norton was a Trustee of the Chicago School of Civics and Philanthropy until it was absorbed by the University of Chicago; he is Vice President of the Board of Trustees of the Chautauqua Institution, President of the Kenwood Improvement Association, Vice President and Director of the Chicago Branch of the National Metal Trades Association, a Director of the Illinois Manufacturers Association, Vice President of the Municipal Art League, and a Trustee of the Orchestral Association of Chicago. He is a member of Alpha Delta Phi, of the Illinois Commandery of the Loyal Legion, and of the Union League, University, Cliff Dwellers, Bohemians, Jackson Park Yacht, and South Shore Country Clubs. His special hobbies are of a sort that take him into the open air and his favorite sports are golf, tennis, and yachting.

THE PRESIDENT'S REPORT

THE report of President H. T. Heald for the past school year, recently presented to the Board of Trustees, is a comprehensive statement of the Institute's activities. We present a brief summary.

The appointment of Dr. L. E. Grinter as Vice President, of Professor P. C. Huntly as Director of the Civil Engineering Department, of Professor J. C. Peebles as Chairman of the Mechanical Engineering Department, and the engagement of new members of the faculty are reported elsewhere in this issue.

Dr. Rufus Oldenburger has been promoted to Associate Professor of Mathematics, Dr. Elder Olson to Associate Professor of English, and Dr. James Potter to Assistant Professor of Physics. Professor Melville B. Wells, for thirty-eight years a member of the Department of Civil Engineering, loved and revered by successive generations of Armour students, retired at the end of the year with the title of Professor Emeritus. Professor Edwin S. Libby, for thirty-four years a member of the Department of Mechanical Engineering, relinquished his teaching duties to become Chief Engineer of the Power Plant on September 1, 1939. Dr. Ralph H. Manley, formerly Assistant Professor of Chemistry, is now devoting practically all of his time to the Research Foundation as Assistant Director. He continues to be a member of the Chemistry Department with the rank of Associate Professor.

Mr. Harold A. Vagtborg has been appointed Executive Secretary to the Board of Trustees. In this position, which he holds in addition to the directorship of the Research Foundation, Mr. Vagtborg's duties will be related to the general Institute development program.

During the year enrollment in day classes continued to increase, again reaching an all-time high. Registration in evening classes showed some decrease from the previous year on account of lessened business activity. College enrollment for 1939-1940 again exceeds that of the previous year.

During the past scholastic year the curriculum in Architecture has been revised to adjust it to the educational program planned by Professor Ludwig Mies van der Rohe, who assumed direction of the Department in September, 1938. Changes have been made with special care to avoid disturbing the continuity of the student's education. The revised curriculum is described in the current issue of the General Information Bulletin.

Substantial revisions have been made in the curriculum in Engineering Science, and the name has been changed to Science. The new program permits a student to specialize in chemistry, mathematics, or physics, at the same time securing an engineering background.

The Cooperative Course in Mechanical Engineering has become an integral part of the Armour program. More than one hundred companies are cooperating, and even during the relatively poor business conditions of the past year employment of cooperative students continued to be good.

Graduate work at the Institute has improved in quality and increased notably in volume during the past year. A feature of the year's work was the award at the 1939 Commencement of the first Doctor of Philosophy degree to be granted by the Institute. At the same time, fourteen Master of Science degrees were awarded, including the first degrees earned exclusively in the evening classes. The number of Master's degrees awarded annually should continue to grow, but the award of Doctors' degrees is not expected to exceed one or two each year until greater facilities are made available. Important improvements in the graduate program can be made possible only by the expenditure of substantial amounts for equipment, research facilities, and teaching staff. Money thus spent will be effective not only in the graduate department, but also in strengthening the undergraduate program and in enhancing the Institute's reputation in all divisions.

More than two hundred volumes were added to the library during the year by gifts from alumni and friends, among the contributors being Mrs. J. Ogden Armour, McCrillis N. Butler, Mrs. F. H. Bernhard, James O. Heyworth Estate, H. F. Hodges, A. A. Koch of the Class of 1932, Colonel Warren R. Roberts, and the Class of 1912.

The most important improvement in physical facilities was the remodeling of the Armour Mission Building as the Student Union. Armour's oldest building has now become its most modern, and the students are provided with facilities long needed for service and comfort. The large three-story house at 3254 Michigan Avenue was acquired for use as a Graduate Club, and has been equipped to provide living quarters for thirty students.

The membership of the Board of Trustees was changed during the year by the death of two members, the resignation of two members, and the election of nine. It is with deep regret that we record the passing of Mr. Homer H. Cooper, General Counsel, and of Mr. Charles H. Strawbridge. Announcements of the election of new members appears in previous issues of the ENGINEER AND ALUMNUS and in the present number. Members of this Board, individually and collectively, have aided the Institute in a great variety of ways.

No one who has observed the affairs of Armour during the past three years can fail to note the signs of real growth and development. Enrollment in the college has grown rapidly, while at the same time the quality of students admitted has steadily improved. Paralleling the growth in enrollment has been an increase in the size of the faculty, and the high quality of the men that the Institute has added to its staff is even more notable

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NEW FACULTY MEMBERS

JOHN W. CALKIN, newly appointed Assistant Professor of Mathematics, comes to us from the Institute for Advanced Study at Princeton and the University of New Hampshire. He received his undergraduate education at St. Stephen's College of Columbia University where he was graduated in 1933. During a three-year interruption of his college career he was engaged in newspaper work and in the automobile business. During the years 1933 to 1937 he did graduate work and taught at Harvard, receiving his M. A. degree in 1934, and his Ph. D. degree in 1937. The school year 1937 to 1938 was spent as research assistant at the Institute for Advanced Study, and the following year as Assistant Professor at the University of New Hampshire.

Professor Calkin is the author of papers dealing with the theory of Hilbert space and the applications of this theory to differential equations. He is a collaborator on the staff of MATHEMATICAL REVIEWS, a new abstracting journal which will begin publication in the near future. He is a member of Phi Beta Kappa and of the American Mathematical Society.

Calkin — Cleveland — Davey — Donnell

Eliassen — Griffis — Hay — Hayakawa

(Monfort Studios)

FORREST F. CLEVELAND, Assistant Professor of Physics, was born in Kentucky. He received his A. B. degree (cum laude) at Transylvania College in 1927, his M. S. degree at the University of Kentucky in 1931, and his Ph. D. degree at the same university in 1934. He has done additional work at the University of Chicago and has been engaged as a special lecturer in research at the University of Michigan during the past summer. Among his other activities has been work as an Instructor in Physics at Transylvania College and at the University of Kentucky. He has been Professor and Head of the Department of Physics and Mathematics at Lynchburg College. In collaboration with Professor Murray, he has carried on research work in the study of Raman spectra and molecular structure with the aid of grants from the A. A. A. S., from Sigma Xi, and from the Virginia Academy of Science.

Dr. Cleveland's publications include numerous abstracts of papers relating to his research activities and various articles in scientific journals. He is the author of a laboratory manual titled EXPERIMENTS IN PHYSICS.

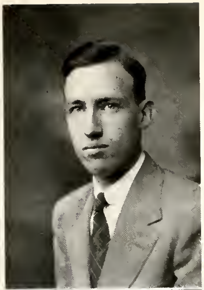
HAROLD W. DAVEY, Instructor in the Department of Social Science, is a graduate of Syracuse University and received his M. A. and Ph. D. degrees at Harvard. His particular field of research has been administrative law and labor relations as is suggested by the title of his thesis, "Administrative Discretion Under the National Labor Relations Act." His academic honors include selection as Salutatorian at Syracuse University; and the award of a University Fellowship in 1937 and an Edward Austin Fellowship in 1938 at Harvard.

Dr. Davey is a member of the American Political Science Association, the American Association for the Advancement of Science, of Phi Beta Kappa, Phi Kappa Phi, and Pi Gamma Mu.

LLOYD HAMILTON DONNELL, Associate Professor of Mechanical Engineering, has had extended experience in industry as well as in teaching. He took his degree of Bachelor of Mechanical Engineering and his Ph. D. degree at the University of Michigan, working under S. Timoshenko. He was engaged in design, testing, research, and stress analysis work for the Franklin, Dodge, and Packard automobile companies from 1915 to 1921. During the next two years he operated a small shop. From 1923 to 1930 he was Instructor and Assistant Professor of Engineering Mechanics at the University of Michigan. From 1930 to 1933 Dr. Donnell was a research fellow in charge of the Aeronautical Structures

Marin — McColley — McDonald — Murphy
Murray — Peck — Sanford — Schultz

(Monfort Studios)



(Monfort Studios)

Trumpler

White

Laboratory of the Guggenheim Aeronautical Laboratories at the California Institute of Technology. For the past six years he has been in charge of the Stress Analysis and Structural Research Departments of the Goodyear-Zeppelin Corporation.

He is the author of numerous technical papers published by the American Society of Mechanical Engineers and other engineering societies. He is a member of the A. S. M. E., Sigma Xi, and the Institute of Aeronautical Sciences.

ROLF ELIASSEN, Assistant Professor of Civil Engineering, is a graduate of the Massachusetts Institute of Technology; he received his M. S. at the same school in 1933, and his Sc. D. degree in 1935. For a year after completing his college work he was engaged as a consulting and designing engineer in Pittsburgh, and for the past three years has been employed by The Dorr Company, Inc., in the construction and operation of water and sewage treatment plants all over the United States. During the past year and a half, the greater part of this work has been on the West Coast. Dr. Eliassen has done a material amount of hydraulic experimental work in addition to his regular assignments.

LE VAN GRIFFIS, Instructor in Civil Engineering, attended the Los Angeles High School and California Institute of Technology, where he received his B. S. degree in 1937 and his M. S. degree in 1938. His experience includes teaching Applied Mechanics at California Tech and a year as research fellow at the same school. He has done research in structures particularly with reference to earthquake effects, in fluid mechanics, and impact phenomena.

Mr. Griffis is a member of Tau Beta Pi, an associate member of Sigma Xi, and a junior member of the American Society of Civil Engineers.

GEORGE EDWARD HAY, Instructor in Mathematics, was born in Grey County, Ontario. He was graduated from Brampton High School and took his university courses at Toronto where he received his B. A. degree (with honor) in 1935, his M. A. degree in 1936, and his Ph. D. in 1939. He held a teaching fellowship from 1935 to 1937, and a scholarship of the National Research Council of Canada from 1937 to 1939. Dr. Hay's special field of interest is mathematical elasticity.

SAMUEL I. HAYAKAWA, Instructor in English, was born in Vancouver, British Columbia. He received his B. A. degree in 1927 at the University of Manitoba, his M. A. degree in 1928 at McGill University, and his Ph. D. in 1935 at the University of Wisconsin.

Dr. Hayakawa came to the United States in 1929 as a Fellow in English Language and Literature at the University of Wisconsin. He first visited Japan in 1935 and his adventures during this journey are recorded in ASIA MAGAZINE for April and May, 1937. He is the author of OLIVER WENDELL HOLMES in the American Writers Series; also of an introductory book on Semantics, LANGUAGE IN ACTION. He has been a contributor to HARPER'S, ASIA MAGAZINE, THE NEW REPUBLIC, THE SEWANEE REVIEW, DALHOUSIE REVIEW, POETRY, AMERICAN LITERATURE, and other magazines. His special fields of interest are American literature and general linguistics.

BRUCE LONGTIN, Instructor in Chemistry, was born at North Fork, California. He attended school at Fresno, California, at Fresno State College, and at the University of California where he received his Ph. D. degree in 1938. From 1934 to 1935 he held a State of California Scholarship, and from 1938 to 1939 a Shell Research Fellowship in Chemistry. Dr. Longtin is a member of Sigma Xi.

ARVID TURNER LONSETH, Instructor in Mathematics, attended the Washington State Normal School from 1930 to 1932, and Stanford University from 1935 to 1939. He received his A. B. degree at Stanford in 1935 and his Ph. D. at California in 1939, both degrees being in Mathematics. He has been teaching assistant at California for the past three years.

JOSEPH MARIN, Assistant Professor of Civil Engineering, has had extended experience in academic work, in research, and in industry. He received his B. A. degree at the University of British Columbia in 1928, the degree of M. A. in Civil Engineering at the University of Illinois in 1930, and the degree of Ph. D. in Engineering Mechanics at the University of Michigan in 1936. He has been on the faculties of the University of British Columbia, at the University of Illinois, and at Rutgers, where for the past five years he has been Assistant Professor of Engineering Materials. Dr. Marin's professional experience includes about one and a half years with the Topographic Division of the Geological Survey of Canada, a summer assignment as structural draftsman and designer for Byllesby Engineering and Management Corporation, a summer engagement in research and development for the Turbine Division of the Westinghouse Electric and Manufacturing Company, and about nine years devoted to mechanical testing, consulting and research work on stress analysis.

He is a member of the American Society of Civil Engineers, the American Society of Mechanical Engineers the American Society for Testing Materials, the American Concrete

Institute, and the Society for the Promotion of Engineering Education. He is licensed as a civil and mechanical engineer in the State of New Jersey. Dr. Marin's honorary society memberships are in Sigma Xi and Tau Beta Pi. He has served on various committees of the societies in which he holds memberships, and has to his credit a large number of publications relating particularly to tests and analyses of stresses.

GRANT McCOLLEY, Assistant Professor of English, comes to Armour from Smith College. His undergraduate work, interrupted by two years service during the World War, was done at Washington University, St. Louis, and at Lake Forest College. His Ph. D. degree was awarded at Northwestern University where Dr. McColley wrote his doctoral dissertation on the Effects of Copernican Astronomy on English Poetry. His publications, largely in the fields of the history of science and the relations of science and literature, have appeared in some twenty American and European journals. He has also edited two books, THE MAN IN THE MOONE of Francis Godwin, the first tale of an inter-planetary voyage in English literature, and THE DEFENSE OF GALILEO of Thomas Campanella, the latter of which he also translated into English.

Dr. McColley is a member of Phi Beta Kappa, the Modern Language Association, the Shakespeare Association, the Mediaeval Academy, and the American Association of University Professors. He has appeared frequently before learned society groups, and on occasion has served as an officer. At present Dr. McColley is a member of the advisory committee of English VI, and Secretary of General Topics VII, both of the Modern Language Association. He was the founder of the latter section which deals with the relations of literature to science.

HUGH J. McDONALD, Instructor in Chemistry, was born in Glengarry County, Ontario. He attended the Glen Nevis High School, Queen's University, and McGill University, where he received the degree B. Sc. in Honor Courses in Chemistry in 1935; and at Carnegie Institute of Technology where he was awarded his M. S. degree in 1936 and his D. Sc. degree in 1939. He held a scholarship of the Royal Society for the Advancement of Science in 1933; a Research Fellowship of the Mining Advisory Board at Carnegie Institute of Technology, 1935 to 1936; a Teaching Fellowship for the next two years; and a Part-time Instructorship from 1938 to 1939. He is a member of the American Chemical Society, and Sigma Xi.

Dr. McDonald's special fields of interest are low-temperature studies, physical chemistry, and the history of science.

EUGENE FRANCIS MURPHY, JR. is a part-time Instructor in Mechanical Engineering. He received the degree of M. E. at Cornell University in 1935 and the degree of M. M. E. at Syracuse University in 1937. During the school year 1935-1936 Mr. Murphy was Graduate Assistant in Mechanical Engineering at Syracuse University, and for two years beginning in 1937 was employed in the Engineering Department of Ingersoll-Rand Company in the air and gas compressor plant at Painted Post, New York. His work there involved experimentation and calculations relating to vibrations and to design problems for compressors intended for special services. During this time he conducted classes for draftsmen and student engineers. Throughout the summer of 1939 Mr. Murphy was at Ithaca, New York, serving as Assistant to Professor F. O. Ellenwood in the revision of the standard heat-power text book written by Barnard, Ellenwood, and Hirshfeld.

M. J. MURRAY, Assistant Professor of Chemistry, has been closely associated at Lynchburg College with Professor Cleveland, now of our Department of Physics. He took his A. B. degree in 1925 at DePauw and his Ph. D. degree in 1929 at Cornell. He has also done graduate work at the University of Illinois. His academic experience has been at Cornell and at Lynchburg where he was Head of the Department of Chemistry up to the time of his appointment to the Armour faculty.

Dr. Murray is a fellow of the American Association for the Advancement of Science and a member of the American Chemical Society, the Piedmont Chemical Society, the Virginia Academy of Science, Phi Beta Kappa, Sigma Xi, Phi Kappa Phi, and Alpha Chi Sigma. He has received numerous scholarships, fellowships and other awards, several of them jointly with Dr. Cleveland for research on the Raman effect. He is the author of a text book on INTRODUCTORY QUALITATIVE ANALYSIS jointly with R. B. Corey, and of numerous papers in the scientific journals.

H. B. NOTTAGE, Instructor in Mechanical Engineering, has been employed most recently in the Testing Agency of the California Department of Motor Vehicles. He has his B. S. and M. S. degrees from the University of California, the latter having been awarded in 1939. Mr. Nottage has been a Research Assistant and Teaching Assistant in Mechanical Engineering at California and has been engaged in special studies in air conditioning under the auspices of the California Committee on the Relation of Electricity to Agriculture. He is a member of the American Society of Engineers, of Tau Beta Pi, and of Sigma Xi.

RALPH E. PECK, Instructor in Chemical Engineering, did his undergraduate work at the University of Minnesota where he received the degree of B. Ch. E. (with distinction) in 1932, and his Ph. D. degree in 1936. His teaching experience has included four years at the University of Minnesota and three years at Drexel Institute. In addition to his teaching assignments, Dr. Peck has had considerable experience in research and has done some industrial consulting work. During the past two years he has attended all of the chemical engineering seminars at the University of Pennsylvania. He is the author of papers in scientific journals, and has at present two research projects in progress. He is a member of Tau Beta Pi, of Phi Lambda Upsilon, and of the American Institute of Chemical Engineers.

ROBERT M. SANFORD, Instructor in the Department of English, received his B. A. degree (with honors) from the University of Florida in 1935 and his M. A. degree from the same school the following year. While doing graduate work at the University of Florida, Mr. Sanford held a grant as Graduate Fellow in English from 1935 to 1936, and a Teaching Fellowship during a part of 1936. He matriculated at Northwestern University in September, 1936, and has held a Tutorial

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HELP! HELP! HELP!

Here is the record of your newly created Placement Department at Armour Tech. We are a year old and the achievements for the year commenced September 20, 1938 and ended August 31, 1939.

Hundreds of alumni during that time were placed in jobs. The salaries aggregate close to $700 000 and the savings in agency fees to the alumni were approximately $25,000. There are over 1,100 up-to-date placement records in our files. There should be 3,000. If you have been negligent in this respect, please send in your record of achievement. This small effort on your part may pay handsome dividends. When men are desired for a good job, their records are carefully analyzed and some are sought for the interview that may lead to fame and fortune. But then perhaps you "good builders of rat traps" think the job will find you. Don't you think that perhaps it might aid to advertise a little that you build *good* rat traps? Try it. It costs nothing but a few moments of time and a stamp.

The records of the 1939 class are accurate. The lads from the class of 1939 have been interviewed by 106 different companies, arranged by the Placement Department. A great many of these interviews were held in the spacious offices of the Department. Here every effort was made to make friends with the various personnel men and afford them every courtesy and comfort. By August 31st 81.5% of the class were employed. At this writing nearly 90% have been placed, and there is still a week to go in September. The average initial salary of the class to date is $110.80 per month ($25.35 per week or .68c per hour). The Department tries to keep up with economic conditions, the history and stability of employing industries, and aids in selling our boys to those concerns where the opportunity to gain experience and the chance for advancement are the best. Of course, we are in competition for jobs with every engineering college in the country.

A year ago 372 men registered with the Department as out of work. Several times during the year every one of those men was employed. However, this condition of employment is in a constant state of flux.

Many alumni desire change of positions due to climatic conditions. Others desire a change involving more responsibility with more pay. Many of our day and evening school lads are looking for part-time jobs, or Saturday and Sunday jobs, or for work during the holidays. If you need the services of a graduate engineer, or that of our day or evening-school students for any kind of a job, or if you hear of an opening anywhere at any time, heed my cry of Help! Help! Help! Telephone, write or telegraph about the opening. This kind of help is a big aid to our own efforts to make contact with industries by mail, telephone and personal calls. Some of you have been very good to us and your efforts to aid us are deeply appreciated.

Write, telephone or telegraph me—31 West 33d Street, Chicago, Illinois, or telephone Victory 4600.

John J. Schommer,
Director of Placement.

STAFF CHANGES



L. E. GRINTER, for the past two years Dean of the Graduate School and Director of the Department of Civil Engineering, has been relieved of his departmental duties and elected Vice President of the Institute. In this capacity he has immediate responsibility, under the President, for the educational program of the Institute. His undergraduate work was at the University of Kansas, and he received his M. A. and Ph. D. degrees at the University of Illinois. Subsequently the University of Kansas conferred on him the professional degree of Civil Engineer. Dr. Grinter has had extended experience in consulting work and in teaching, and is the author of two important books on steel structures.

JAMES C. PEEBLES, former Professor of Experimental Engineering, and director of the insulation laboratories of the Research Foundation has been appointed Chairman of the Department of Mechanical Engineering. Professor Peebles is a graduate of Armour; he received the degree of Bachelor of Science in Electrical Engineering in 1904, and the degree of Electrical Engineer in 1908. After graduate work at Cornell University he received his master's degree there. He has been a member of the Institut faculty for thirty-one years.

PHILIP C. HUNTLY, formerly Director of the Department of Mechanical Engineering, has been transferred to the post of Director of the Department of Civil Engineering. Professor Huntly, a graduate of the University of Arkansas, came to Armour in 1914 as Instructor in Mechanical Engineering. In 1930 he was promoted to the rank of Professor, and in 1934 he became head of the department.

Engineer Staff Changes

This number of the Armour Engineer and Alumnus is published by a new editorial and business staff.

Four years ago, the Armour Engineer, for many years a student publication, was reorganized and renamed, and became an important agency of students, administration, and alumni. Walter Hendricks, as Editor-in-chief, and David P. Moreton, as Business Manager, undertook the publication of what was practically a new magazine. Their work was well done, and the Institute has had creditable representation in the list of college periodicals.

Last winter, Professor Moreton found it necessary to take leave of absence from the Institute on account of ill health, and the post of Business Manager of the magazine was assumed temporarily by A. B. Lewis. At the end of the school year, Professor Hendricks at his own request was relieved of his duties as Editor-in-chief in order to devote all his time to research and to his duties as Chairman of the Department of Language and Literature.

The new staff assumes its responsibilities with realization that maintenance of the high standard that has been set during the past four years will be an exacting task.

Professor Moreton's many friends will be pleased to know that he has recovered his health, and that he has returned to his teaching duties in the Department of Electrical Engineering.

COMMENTS UPON THE OPENING OF 1939-40 OFFICE OF THE DEAN, THE UNDERGRADUATE COLLEGE

ENROLLMENT. We have all seen in print and heard comment upon Armour's increased enrollment—an increase which has been annual since the first semester of 1935-36, when the total was 786 of which 720 were undergraduates, and there were no Co-ops. The total for this semester is about 1,450, of which 300 are Co-ops and 55 post-graduate students, leaving for the College, exclusive of Co-ops, 1,095—a very substantial gain for four years. It is important to know the manner of this growth rather than simply its size, and to realize that it has not been due to a year-by-year increase in the number of new students accepted for enrollment. Thus, in 1935-36 there were about 200 freshmen; in 1936-37 there were just under 300; in 1937-38, 316; in 1938-39, 320; in 1939-40, 324—an approximately constant figure, kept so by increasingly careful selection, stopping at capacity.

The increase in the past four years, including this year, has been successively in each of the three upper classes, until this year the senior class numbers about 200 instead of the 139 who were graduated last June. The Undergraduate College in the four-year program is now approximately in equilibrium at capacity for present facilities. The Cooperative Course, started in February, 1936, has now admitted four classes, and will admit the fifth in February, 1940, the first class being ready for graduation in February, 1941. Thus, the maximum enrollment should be reached in February next (1940), and equilibrium reached until major additions to facilities are made.

ORIENTATION. In September, 1938, the first Orientation Week for freshmen was inaugurated at Armour. Registration for freshmen was held on a Monday, a full week ahead of the opening of classes. Returning students registered on Friday following the Monday upon which freshmen registered. On the Tuesday, Wednesday, Thursday, and Friday following freshman registration, all new students attended assemblies, took the extensive program of educational tests now required of entering students, met in small groups with representative senior undergraduate leaders, and participated in social events sponsored by fraternity chapters. Incidentally, this program eliminated the traditional "rush week" in October, which annually handicapped not only many freshmen, but also numerous upper-class fraternity men. The program was continued in the present year, with improvements suggested by experience, many of them made possible by the new facilities offered by the Student Union.

CURRICULUM CHANGES. Last spring the faculty adopted the report of the Curriculum Committee which recommended the setting up of a curriculum in Science replacing the curriculum in Engineering Science. The new program has major sequences in Chemistry, Mathematics, and Physics, leading to the undesignated degree of Bachelor of Science. The Science program is under the direction of Professor C. E. Paul, Chairman of Mechanics, and an administrative committee consisting of Professors B. B. Freud, L. R. Ford, and J. S. Thompson, the Chairmen of Chemistry, Mathematics, and Physics, respectively.

C. A. Tibbals.

EVENING DIVISION GROWS

WHILE it is too early to predict the final registration in the Evening Division, it stands at 1,784 at this writing, as compared with 1,580 a year ago.

A new plan of registration was well received this year. The new system brought every student into contact with a faculty adviser for help in laying out a plan of study and in avoiding mistakes due to lack of knowledge of correct course sequences.

There is a growing interest in courses which carry college credit. Perhaps three out of every five men interviewed by one adviser wanted to take work which could be counted toward a degree. To meet this growing demand for a complete undergraduate course, the Institute hopes soon to announce a plan by which, in some of the major curricula, courses will be so grouped in alternate years that students will find workable schedules available from year to year.

Extension work is becoming a regular part of the evening program. The course in Iron and Steel Production, given last year for the Association of Iron and Steel Engineers in East Chicago to about 100 men, is to be repeated and the Institute has arranged a series of lectures for an industrial group in Waukegan. Other inquiries have been received.

A new departure in teaching is being undertaken in connection with the course in Industrial Management given by Norman Schreiber. A few members of the class have arranged to receive a special advisory service in connection with the regular class. These men, under Mr. Schreiber's direction, prepare analyses of their own businesses, calculated to suggest points for improvement.

Why do Evening Division men decide to come to Armour? There are many reasons; all the various activities of the Institute, which have expanded so markedly in recent years, contribute. Increased advertising in the daily papers doubtless influences many. It was most interesting in counseling applicants for evening courses, to note how often a man had been advised by his superior or a fellow-employee (frequently an Armour alumnus) to come to Armour in order to learn how to handle his job better or to prepare for promotion.

Last year the typical student in evening classes attended two evenings a week and took one or two subjects. There is a tendency this year to increase the number of subjects, which under the new class schedules can frequently be fitted to advantage into three evenings of attendance.

Some students come four nights a week. A man giving four evenings to class attendance, in addition to the time for preparation, must either be very much in earnest or must find his classes enjoyable in themselves. Probably both reasons often enter the picture. One wonders what the wives (if any) say about such programs. Apparently they approve in some cases, at least. It was not unusual to see a registrant accompanied by a young lady who took a serious interest in the proceedings. Speaking of the ladies, the Evening Division will have several co-eds this year.

So opens another year. It will be a year, we hope, in which the Institute may worthily play its part in the ever-growing movement on the part of employed men to keep abreast of their job's and their world, by learning in school, as well as on the job.

H. P. Dutton.

AWARD OF HONORARY DEGREES

At the forty-third annual commencement of Armour Institute of Technology, the honorary degree of Doctor of Engineering was conferred upon two outstanding engineers.

The story of the business career of JOSEPH S. DUNCAN is told elsewhere in this issue. He came to Chicago in the year of the World's Columbian Exposition and began the manufacture and sale of the Addressograph on a very small scale. He rapidly made improvements in his machine, studying the mechanical problems involved, and making up for the deficiencies in his mechanical background by constant application and diligent study. The Addressograph Company was organized in 1896, and rapidly increased in size, eventually occupying a large plant at Van Buren and Peoria Streets, with a branch plant in New York. In 1926, Mr. Duncan sold his interest in the company, and the Addressograph-Multigraph Corporation was formed. In the course of Mr. Duncan's development of the Addressograph he became the holder of 160 United States patents and 40 foreign patents.

Although he has retired from active business affairs, Mr. Duncan finds occupation and recreation in generous support of organizations working with the younger generation. He is the donor of the Duncan Department of the Y. M. C. A. on Chicago's west side, and maintains Camp Duncan for under-privileged boys from the same area.

Mr. Duncan was married to Adelaide V. Yockey of Stafford, Ohio, on February 9, 1888. He is a member of the Franklin Institute, the Art Institute of Chicago, the Chicago Historical Society, and of the Union League, Chicago Athletic, South Shore Country, and Beverly Country Clubs.

HOWARD L. KRUM was born in Minneapolis on November 15, 1883. Soon thereafter his parents moved to Chicago. He attended Armour Institute of Technology, where he received the degree of Bachelor of Science in 1906, and the degree of Electrical Engineer in 1910. Shortly after Mr. Krum's graduation from college, he was made General Manager and Director of the Morkrum Company. Later he became Vice President and Director of the Morkrum-Kleinschmidt Corporation, and when this company was reorganized as the Teletype Corporation he was elected Vice President. He resigned from this office in 1938, and is now associated with the company in a consulting capacity.

He was married to Fay Wilson on October 29, 1919. They have three children, Charles Wilson, Shirley Jean, and Marjorie Lyon. He now lives in Beverly Hills, California.

Mr. Krum is a Trustee of Armour Institute of Technology, a Fellow of the American Institute of Electrical Engineers, and a member of Tau Beta Pi. On June 2, 1933, he received a distinguished service award from the Alumni Association of Armour Institute for outstanding accomplishment in the field of electrical invention.

THE ANNUAL GIFT PROGRAM

The financial program sponsored by the Alumni Association during 1938-39 to help pay for the furnishings and equipment of the Student Union was well received and supported. A detailed report covering the total sums subscribed and collected for AN ANNUAL GIFT FROM EVERY ALUMNUS will appear in the next issue of the ARMOUR ENGINEER AND ALUMNUS.

As Chairman of the Committee in charge of this Alumni effort to promote annual gifts to the Armour Institute, I want to utilize this last opportunity before turning over the reins to my successor for 1939-40 to express my sincere appreciation to all those Alumni who unselfishly gave of their time and money to make AN ANNUAL GIFT FROM EVERY ALUMNUS the success it was.

Let me conclude my farewell by extolling the wholehearted cooperation afforded my committees by the authorities at the Institute, the ARMOUR ENGINEER AND ALUMNUS, the Board of Managers and Officers of the Alumni Association, and all the Alumni who so kindly served on the committees, without which cooperative assistance my efforts and planning would have been in vain.

J. WARREN McCAFFREY, *Chairman.*

Note: Mr. McCaffrey's successor will be chosen by the Alumni Association in the near future. The December issue will contain a report on the continuing activities of the program.

Editor.

ALUMNI NOTES

By

A. H. JENS, '31

WITH this issue of the Engineer and Alumnus there appears a new editor to handle Alumni affairs. In this capacity we have discussed various problems with many Armour men, mostly concerning the method in which items on Alumni affairs should appear. The style you see now is experimental. We shall make changes from time to time and then seek to learn from you the style you prefer. In this connection we ask your cooperation in advising the Alumni office of any marriages, births, anniversaries, changes in position or address, and the like for yourself or other Armour men with whom you come in contact.

We have wondered many times during the past few years why it was that loyalty to one's school reached such a peak at the time of graduation and then nosedived into nothing thereafter. College loyalty is developed, unobtrusively to be sure, in the transition from freshman to senior by contacts in the classroom, on the athletic field, and in the fraternity. Yet, when graduation day is reached, the "old spirit" dies. The very spirit that made college life so pleasant is a thing of the past. Why, when there are means of manifesting this spirit, do so many Armour men permit themselves to lose contact with *their school?* The Alumni Association and this magazine are perhaps the only means of contact for many of our 3800 graduates. So why not join hands with us in an attempt to bring the present Armour to you? We believe a new era is a-borning and we bespeak the wholehearted cooperation of every Armour man.

Again John Schommer made the public print in Arch Ward's column, *In the Wake of the News,* in the Chicago Tribune on September 15, as follows: "There are at least two officials in sports whose decisions are accepted by a vast majority of fans as 100 per cent fair and accurate. . . . One is Will Harridge, president of the American league, and the other John Schommer, Big Ten football and basketball official." And so it goes.

Under date of May 4, the *National Underwriter,* insurance magazine, carried the following paragraph:

"So highly does the management of the Home fleet regard the technical training furnished by Armour Institute of Chicago that it has in its employ no less than seventeen men who have finished the course. Of the number, Secretary Leonard Peterson and Assistant Secretary Arnold Grasse are at the head office, the others being at strategic centers throughout the country."

John Byrne, who entered Armour last month, is the son of Louis J. Byrne, M.E. '04. His uncle, William M. Byrne, was a member of the class of '03 in mechanical engineering. John is also a mechanical.

Numerous inquiries have been made to the Alumni office concerning the Alumni Directory. Those who filled out the original information cards may have their copies by sending twenty cents each to the Alumni office. There are a very limited number of copies available to those men who subscribe to the life membership plan of the Alumni Association, or pay all back and current dues to the Association, or make a rather substantial gift to the Annual Gift Program.

Efforts will be made to clear outstanding accounts with the Alumni Association in the very near future. You will facilitate handling this work by sending through checks for your current dues. As you may know, these are one dollar per year and include subscription to this magazine.

1897

GERALD MAHONY, E. E., writes from Elkhart, Indiana, under date of May 19, 1939, in part as follows:

I can't for the life of me remember what year I was turned out of Armour Institute of Technology to begin to absorb knowledge but I do remember that ours was the first class to graduate. When the sheepskins were handed out at the graduation ceremony I reached for mine with my left hand and have been pulling that sort of stunt ever since.

As I write I am thinking over what I have accomplished in the short span of life since that date and have come to the conclusion that my securing that diploma is perhaps my major accomplishment. When I learned, about three years after graduating, that C. P. Steinmetz was paid only $5,000 a year by the General Electric Company I said to myself that I would quit engineering and try selling. Have been trying to sell ever since. The executives of the companies whose products I tried to sell, after looking over my sales record, decided to give me one more chance to sell something and sent me abroad. As this insured the travelling and living expenses of myself and family I have periodically allowed myself to be exported. They all seemed glad to pay the return expenses to get me out of the foreign field.

1904

FREDERICK L. COLLINS, E. E., writes to the Alumni Office under date of June 28, 1939, from Gary, Indiana, in part as follows: Regarding news items there is very little to tell. Family life has been that of a normal family. We have raised four children, three girls and one boy. The two oldest girls are married. One is living at Urbana, Illinois, and married to Mr. Robert Martin, Professor of Mathematics. Our second girl is married to a brother, Mr. Stewart Martin, and is living at Annapolis,

Maryland, where he is an official of St. John's College. The third is a boy who is studying architectural engineering at the University of Illinois. Our youngest girl is now in England studying dramatics at the Royal Academy of Dramatic Arts in London. We expect her return next fall. That is about all there is—nothing startling.

1912

RICHARD C. ARMSTRONG, E. E., writes to the Alumni Office from Melbourne, Australia, under date of June 12, 1939 as follows:

My thanks are long overdue to you for copies of the Armour Engineer and Alumnus which have been coming regularly to hand for a considerable time.

Possibly because of that regularity I have come to look for them, for I find them very interesting as showing the growth and development of Armour, and the trend of technical education in U. S. A. But more than that, I appreciate the efforts my old college has made to keep in touch with a graduate, who will always remember with a great deal of satisfaction the busy, interesting, and altogether satisfactory period of four years of his student days in Chicago.

My interests are perforce chiefly in this city where my work and home are, but it affords me a great deal of pleasure nevertheless to be remembered by those with whom I spent those four undergraduate years.

1919

The Class of 1919 held its 20th reunion at the time of the Alumni Banquet in June. Organization of Class of '19 activities for that day was under the direction of Erling H. Lunde. Mr. Lunde's report is as follows:

Our table of "nineteeners" celebrating our 20th had a very pleasant reunion. Some of us hadn't seen each other for 20 years. Those who attended were:

Hubert F. Rehfeldt, M. E.

*Dr. Clarence W. Muehlberger, Ch. E.

Raymond O. Joslyn, E. E.

Lynn E. Davies, M. E.

Jacob A. Keeth, M. E.

Daniel C. Berg, M. E.

Edward W. Scheuer, E. E. Ex-19

Harry K. Wertheimer, M. E. Ex-19

Erling H. Lunde, M. E.

*Ben W. Lewis, Ch. E.

*Class of '20 but adopted for the reunion.

We organized for our 25th Anniversary under the general chairmanship of Ray Joslyn.

Ed. Note: We print below, in part, a letter sent to Mr. Lunde by M. C. Veremis from Athens, Greece, and dated June 19, 1939.

I remember with great pleasure my first visit to Armour in 1914, two years after my arrival in good old U.S.A. I needed the two years to make the money I would need to finish school, and also build up my English vocabulary.

Bashful, shy, full of fear that I should never be able to enter and finish school, I met at the entrance of Armour that grand old man, Dean Monin! Everybody's friend! He extended to me a friendly hand, and asked me what I wanted—I replied in broken English, "I like to come to school." He took me to his office, he spoke to me in Greek, and within ten minutes I was determined to join Armour, being certain that with such people around me, I would fight on successfully!

Dean Monin was proud to say later in 1918: "My friend Veremis, the bashful boy of 1914, is now a brave 2nd Lieutenant of the American Army."

Getting inspiration and courage from him and my beloved boy friends, I graduated in 1919.

It is now 20 years since I left dear Armour, and joined the testing department of another noble organization, the General Electric Company.

Two years later, in 1921, I was sent to Nome, Alaska, to install the necessary machinery and transmission lines for gold mining by means of water dredging.

Upon my return in 1922 I was sent to the other end of America, in Santiago, Chile, where eventually I became Chief of the Merchandising Department of the company.

In 1925 I installed the first broadcasting station of South America in Santiago, where I remained until 1930, the year of my return and establishment in Athens.

The four years at Armour and eleven years with the G. E. Company are the best of my life so far. Everybody from the highest official to the office boy, were all good to me, friendly, unselfish, sincere, being men of duty, hard workers, qualities which one finds mostly among real Americans. They taught me to be one of them.

With these American qualities, I easily went ahead here. I am at present Chief Engineer of the EVGA National Milk Co., the biggest one in the Balkans; it has a branch in Chicago. I am also the Chief Engineer of Neon Electric Sign Co., and consulting engineer of various smaller manufacturing industries. I direct also an office undertaking general contracting for building and maintenance.

There is nothing in the world that would have pleased me more than to be able to sit at the table with you, my dear comrades of the Class of '19, and fully celebrate with all my heart and soul its 20th reunion. I am "far, yet so near you," however; I cannot even assist our inspiring friend Schommer, sending him some dollars because export of gold from Greece is forbidden by law since 1935.

I assure you all that my heart and soul are with you, and if any one, or all of you ever come to or near Athens, telephone to me 2F-536, and I shall be there! I may add that I met an A.I.T. man in Alaska, two of them in Chile, and not very long ago one in Phaliron, Greece. You see they are scattered all over the world doing their duty.

1925

NORMAN OSTRIN, M. E., announces the arrival of David Irving Ostrin on January 17, 1939. A potential member of the Class of 1960 if he follows in his dad's footsteps.

1927

REV. JOHN L. KNAPP, M. E., in referring to the annual gift program wrote from Ironwood, Michigan in part as follows:

The size of this giving does not begin to symbolize the deep affection for Armour that is in my heart. I hope to get back into close contact with the Institute, and, if possible, merge some of my unusual experiences as a missionary, with that of my many Armour friends. Up here on the Iron Range, I work among many engineers of all kinds. In fact, there are three of us here in Ironwood who are Armour men. My five years experience as a production engineer in factory work and the seven years in the work of the Episcopal Church have given me broad views of the social and economic problems of our day. It is a new kind of engineering; one, I find, that is full of great interest and promise.

Please accept my best wishes for the success of our financial campaign.

1928

EVERETT E. GRAMER, E. E., announces the arrival of Patricia Ellen Gramer at the University Hospital on April 28, 1939.

1929

JOHN W. TEKER, E. E., was married on July 22, 1939 to Marjorie Esabell Bole in Erie, Pennsylvania.

Mr. and Mrs. Teker will reside at 3357 Woodlawn Avenue, Wesleyville, Pennsylvania.

1930

ALFRED C. GUNTHER, F. P. E., who has been in the engineering department of the Chicago office of the National Fire Insurance Company was transferred to Columbus, Ohio as special agent and production engineer. He was with the Oklahoma Inspection Bureau and the Western Factory Insurance Association before going to the western department of the National Fire.

HARLEY W. MULLINS, F. P. E., who has served in the engineering department of the Western Department of the National Fire and for the past few years has been located in Detroit as a production engineer in Michigan, northern Indiana, and parts of Ohio, has been appointed state agent for Indiana. He was with the Michigan Inspection Bureau for six and one-half years prior to entering the service of the National Fire.

WILLIAM B. SWANSON, F. P. E., formerly with the Fire Underwriters Inspection Bureau in Minneapolis has joined the Home of New York as special agent in South Dakota with headquarters at Fargo, North Dakota.

1931

ALVIN B. AUERBACH, C. E., was transferred in September from Corozal, Canal Zone to Ft. Belvoir, Virginia. Auerbach is a Second Lieutenant, Corp of Engineers, U. S. Army. He will attend the Engineer School conducted by the Army at Ft. Belvoir.

DANIEL J. IVERSON, C. E., was married on September 30, 1939, to Miss Helen Zeitler of Winthrop Harbor in Chicago. Reception was held in Winthrop Harbor; President and Mrs. Heald represented the Institute and Eldon A. Johnson and Art Jens the Class of '31. The Iversons will reside at 2209 Ridge Avenue, Evanston.

AUGUST J. LENKE, F. P. E., early in August joined the engineering department of the Chicago office of the National Fire Insurance Company. His duties for the present will consist of engineering work in and about Chicago with headquarters at 175 W. Jackson Blvd. Lenke was formerly connected with the Chicago Board of Underwriters for whom he served in many capacities from October, 1931. Prior to that time he spent several months with the Wisconsin Inspection Bureau in Milwaukee.

1932

JOSEPH B. FINNEGAN, JR., F. P. E., announces the arrival, on September 25th, of a daughter, Mary Louise, born in Indianapolis. Finnegan is a field man in Indiana for the Crum and Forster Fleet of fire insurance companies,—one of nine Armour Fire Protects in that organization.

HOWARD S. HENDRICKS, F. P. E., formerly with the Tennessee Inspection Bureau at Knoxville, Tennessee has joined the Chicago Brokerage and Service department of the Home Insurance Company of New York as special agent.

CHARLES J. JENS, F. P. E., joined the improved risk department of the Great American Insurance Company in Chicago on July 1st. He had been connected with Leedom, O'Connor and Noyes in Milwaukee for several years as an engineer and prior to that time was with the Fire Insurance Rating Bureau in Eau Claire and Milwaukee. Jens has been conducting insurance classes at the University of Wisconsin Extension Division in Milwaukee during the last year. His Chicago address is 6423 Newgard Avenue.

ALBERT A. KOCH, C. E., was married on May 10, 1939 to Miss Jeanne Elizabeth Gurd at Redlands, California. They will reside at 2514 Piedmont Avenue, Berkeley, California.

1933

ELMER E. SADEMAN, F. P. E., who has served in the engineering department of the Chicago Office of the National Fire Insurance Company since February has been transferred to Detroit as a production engineer working the State of Michigan. Sademan spent 5½ years with the Ohio Inspection Bureau prior to entering the service of the National Fire.

WALTER J. WELDON, F. P. E., recently left the Kentucky Inspection Bureau, where he has spent the past five years, for the engineering department of the America Fore Fire Insurance Companies. He will locate in Chicago.

1934

CHARLES D. SPANGLER, C. E., according to information recently received in the Alumni office was leaving his position with the Illinois Department of Public Health to accept a one-year research fellowship at Yale. He will do work towards an advanced degree in bacteriology.

1935

JOHN J. AHERN, F. P. E., who has been in the Chicago engineering department of the Insurance Company of North America, was sent to Detroit early in July as special agent for Wayne County.

STANLEY BERNSTEIN, C. E., is engaged to marry Miss Bettye Miller of Peoria, according to recent newspaper announcement.

1936

WILLIAM J. FLEIG, E. E., was married on June 10, 1939 to Miss Marjorie Lucille Landes at Grace Evangelical Church in Chicago.

HARRY BECKWITH, Arch., was married on June 10, 1939 to Miss Ethel Nelson, according to newspaper announcement. They are to reside at 2630 East 78th Street, Chicago.

1937

EDWARD N. HEINZ, JR., Ch. E., is engaged to marry Miss Dorothy Norrine Patterson of 115 South Austin Blvd., according to newspaper announcement.

1938

JOHN W. ANDERSON, E. E., was married on May 20, 1939 to Miss Lilian Olson.

CHARACTER IN INDUSTRY

(From page 14)

all have the same rights. A "softy" boss is worse than a "bully" boss, and both of them are no good. Strict fairness means that a man must do his task well, correctly, and that his foreman, or the foreman's foreman, or the superintendent's foreman, who is the manager, must show him how to do his work correctly and be fair about it.

He must be lenient with errors of commission and severe on errors of omission, because a committed error is usually done by a man who is over-anxious to do his job well. So fairness is the most important trait that an executive can have.

Needless to say, he must never have favorites. Unfortunately, we see a great deal of that in industry. There is a "white-haired boy" usually in every department, and whether you are a sales manager or whether you are a foreman or a chief clerk, whatever your job may be, there is always some particular individual you like pretty well and you have to be very careful, because grown men are just like any group of school-boys—they know who "teacher's pet" is.

There is one other thing you ought to remember. Every executive has a very definite responsibility to the stockholders, or owners, of the company.

Right here I want to interject something. Undoubtedly a lot of you have heard speakers who have glibly condemned capitalism. At the same time you have always noted that their own particular brand of capitalism is excepted; and you have also noted further that they never define capitalism. If they attempted to do so, they would be so busy with their research work that they would have no time left to talk.

The only reason this is mentioned is that practically every man, woman and child in this country is either a stockholder, an insurance policy holder or beneficiary under an insurance policy. Consequently, they are all stockholders in business, they are all owners and they are all capitalists. That is true of almost everybody in the United States, without exception. Until every curvature of the brain and the chemical makeup of every individual born in this world is standardized, and kept so, we will have individualism and hence, capitalism. These glib talkers on capitalism should start in with biological research.

The majority of the industrial organizations of the country have as owners a very large number of stockholders, and control rests in the many. Therefore, an executive not only must always remember that in his job he has many, many mouths to help feed amongst employees, but also that he has many, many mouths to help feed amongst the stockholders. He should keep these two things equally balanced in his mind at all times. If he harms one group, he harms the other. They are tied in so closely to each other that they cannot be separated, regardless of all the pettifogging theories that are abroad in the land today.

I believe I have given you enough of my ideas as to the human qualities an executive should possess, and I can say honestly that we follow them out. They are not original; you have heard these thoughts hundreds of times. The first man who discussed them with me, George M. Hunter, did so when I started to work down in Gary for the American Bridge Company. He was one of the greatest leaders of men I have ever known, and the thing that he always was interested in most was character.

We are usually able to learn about a man's technological ability from his references and his educational background. We know that when a man applies for work he gives as reference a certain number of employers or teachers, and unless he has done something absolutely vicious, the employer or teacher will never say anything against his character. Employers won't say he is lazy or slothful or anything like that, but they will state whether he is a fairly good workman, or not particularly skilled, so that the wage rate can be fixed for the man. But on the all-important thing as to whether that man is going to be a really good asset, and on phases of character, they just don't tell. That is because you as a recommender, or I as a recommender, are too decent to keep him from getting another start. We are always hoping that he will get a good start somewhere else and hence, while we do give a good slant on his technical development, we do not speak frankly regarding his character.

By observing a man closely for four or five days you can tell whether he can handle a technological job or

not, regardless of the kind of work. But it usually takes sixty days before you can make up your mind as to what kind of a man he is. If he is a good man and has enough technological development to stick to his job and keep the pace of your organization for sixty days, he is going to improve, if he has character.

Consider the work that Armour Institute is doing. We have Armour cooperative students in our factory. They are a fine group of young men. They work hard, well and intelligently. In addition to their college course and their factory work they are showing a splendid spirit of cooperation. We have had only one boy out of the whole lot that came to us who fell by the wayside. It was a defect in character and not lack of technical skill that cost him his job.

Probably every one of these beginners spoils $700 to $800 worth of work for us, and costs from $500 to $1,000 in work delay. But they will make it up in their second year and eventually repay us many times over. However, if you meet with a character defect in one of them, you are whipped as far as he is concerned.

I firmly believe that every man has more good in him than bad. It takes a lot of development with some people, but there are very few men who cannot be trained under the proper leadership. However, if you have a man who is basically dishonest, do not fool with him. Give him a couple of chances, but the second or third time this trait shows up, push him out.

Do not believe that jobs were ever easy to find. They were probably even harder to find in former years than today, because technical education was not so sought for in employees then as it is today.

In closing, don't be snobbish about your first job or how much it pays, but keep your eyes ahead, always work hard, keep your character bright and fine, hold to your religion, and life will open up as a happy and great adventure before you.

I have my heroes — in industry, Henry Ford and George Hunter; in finance, Alexander Hamilton; in education, Charles William Eliot; in politics, George Washington, Thomas Jefferson and Abraham Lincoln; in science, Edison, Marconi, and the Wrights; in law, Marshall and Vandeventer. Of living great men, Henry Ford is not only a great business leader, but a great humanitarian. The Doctors Compton, the Curies, Paderewski and Fritz Kriesler are revered by us all. Charles Dawes of Chicago is also one of our really big men.

Many others loom large, but you will see that my heroes are not those whose names emblazon the headlines, but rather are those whose great character, coupled with achievement in natural abilities, have made them a real inspiration.

INVESTMENT IN COOPERATIVE EDUCATION

(From page 16)

sequence of the student's progress through the plant, with a view to utilizing his time to the best advantage, and giving him experience on all the various functional processes of the shop and also in the engineering and administrative sections. In this scheduling it is intended that as soon as a student learns a particular production job he shall be moved to the next job, since there is no point in retaining him on a job on which he can learn nothing more.

As far as adaptability is concerned, these students have been willing workers, ready to tackle even the hot and heavy work in the shop. They have shown ability to learn the new jobs in a short time, as they are transferred from place to place, and in a few weeks are able to produce a full day's work on piece-work jobs. They become quickly adjusted to the new surroundings and get along well with their supervisors and the men with whom they work.

Payment for the shop period is made on a weekly basis with increases in rate each year. They are kept on the job throughout slack periods, and when no production work is available, they are used in other departments of the plant.

Naturally, as pointed out before, and as indicated by these details of the operation of the plan, such a program does require a large investment of time and effort and interest on the part of Management, to give it the proper supervision and encouragement not only to get it started but to carry it through. It is not a plan that can be started and then allowed to run by its own momentum. Any plan that has as its purpose the training and building of men requires a real investment on the part of Management.

A good investment always pays dividends, and if this investment in education and training is carefully made, there will be dividends, represented not only in the acquiring of an intelligent working force while these students are on production work, but also in the acquisition of a future supervisory and executive personnel that has both the scholastic training and the necessary ground work in shop methods, materials, and equipment, that has become adjusted and acclimated to the atmosphere of industrial production, and that has learned the art of cooperation in working together toward a common goal.

PROGRESS OF A PIONEER

(From page 20)

first, the hen or the egg. Ponder, for an instant, the influence of good roads upon the purely cultural aspects of life, upon our educational achievements, upon our religious life, upon our social activities. Then consider their effect upon our national consciousness through travel and through dissemination of newspapers and magazines and other forms of rapid transmission of information. Good roads bring doctors to sick beds, make vital statistics possible, enable law enforcement officers to function. And what of their value to our rural population? What would our dinner tables look like next week if our roads disappeared today? What have good roads done to assist in the decentralization of industry? These are only a very few of the blessings of a highway system.

When speaking of a contribution to our economic and social life, it might be well to defend the track-type tractor in considering the part it played in the World War. European landowners had been using the machines for several years before the outbreak of this catastrophe, and military men were not long in discovering that this was just the type of prime mover they wanted to haul artillery and supplies over rough terrain.

The tanks, contrary to a popular misconception, were not the product nor an adaptation of the product of American tractor manufacturers, though admittedly inspired by the track-type tractor. The thousands of track-type tractors that were used in the World War served to displace horses and mules for hauling power—perhaps even in that service they made a contribution to progress. In any case, the war did one thing—it popularized this type of machine—showed its possibilities as a builder as well as a destroyer.

Snow, of course, presents its own problem of roads good and bad, but here again the track-type tractor contributes its services to the speedy and economical removal of snow from both primary and secondary roads — extending their use through the twelve months of the year.

Track-type tractors follow in the wake of disaster. Behind the floods of Louisville and Los Angeles and the windstorms of Florida and New England have gone fleets of these machines helping to re-establish communication and transportation, to prevent epidemics, to repair water and other public service facilities. While in California they worked to salvage the land itself, in New England they toiled to get timber into the hands of the public before it was destroyed by the ravages of decay or fire.

Great homage is due the men of the engineering profession because, all through the history of the track-type tractor as it has been put to ever more difficult and more severe tasks, it has been the engineers—the designers, the metallurgists, the experimental staffs, the field observers—who have met the challenge by designing ever better machines.

THE AVIATION INDUSTRY

(From page 21)

valves and cylinders begun in the McCook Field laboratories in 1919. The methods evolved there resulted directly in the production of the famous Wright J-5 "Whirlwind." The higher-powered air-cooled engines of today gradually followed.

As the result of an investigation of heat losses in water-cooled cylinders, ethylene-glycol was tried in 1923 at McCook Field as a possible high-temperature cooling element. The result was the gradual obsolescence of water-cooled engines, a sixty-five per cent reduction in radiator size, and a decided saving in weight.

The development of superchargers was a pioneering venture on the part of Materiel Division engineers and this has become a prime factor in the high performance derived from present power plants. In the past few years, the supercharger has been applied to cockpits for the comfort of passengers. The Lockheed C-35 built for the Air Corps incorporates a supercharged pressure-cabin which not only proves highly successful in test flight but has caused the supercharger feature to be adapted to other types of aircraft for altitude flying.

Other studies by the Materiel Division have resulted in: Development of 100-octane fuel, in cooperation with the fuel industry, which has resulted in increased power output.

Perfection of an oil-dilution system and priming system to facilitate the starting of engines in cold weather.

Development of instruments for recording vibrations in propeller-crank shaft combinations in high-speed airplanes and with these the subsequent perfection of a simple vibration-damping mechanism.

Design of navigation and landing lights, revolving beacons, boundary and obstacle lights, and floodlights for night airways.

Development of navigation and flight instruments which have made possible the first solo blind landing and the first automatic landing of airplanes by Air Corps officers.

Development in cooperation with the Signal Corps of the first radio beacon which has resulted in the present-day system of radio-beacon equipment for cross-country flying.

Transition from wood to metal propellers and more recently to constant-speed, controllable-pitch, full-feathering propellers, as the result of studies at McCook Field.

Improved photographic technique, new films, and faster shutters and lenses which have made it possible to obtain photographs at distances as great as 331 miles. The new highly sensitized haze-penetration film has given good results in photographing through fog.

PRESIDENT'S REPORT

(From page 25)

than their large number. However, the present strength of the faculty is not by any means due entirely to the recent additions. The wholehearted cooperation given by older faculty members, as well as by the newer ones, has been an important factor in improving the general effectiveness of the whole institution.

The growth of the Research Foundation and the establishment of a strong graduate program, with its increased emphasis on faculty research, have been stimulating influences. The cooperative program in Mechanical Engineering has won wide acceptance both within the institution and among the industries of the Chicago area. Evening classes are serving the needs of the community more effectively than ever before and promise to be increasingly effective in years to come. Marked improvements have been made in plant and equipment.

Public interest and support for Armour has been measurably improved and the Board of Trustees has been greatly strengthened. Financially, Armour is on a sound basis as evidenced by the fact that operating expenses are within operating income. Certainly this record of progress in the face of relatively meager financial support is a creditable one. How much more useful Armour's services could be! How much better could youth and industry be served with more adequate financial support! Surely it would be difficult to find a better place to make an investment in the future of America.

NEW FACULTY MEMBERS

(From page 30)

Fellowship, a University Research Fellowship, and a second Tutorial Fellowship at the same university. Mr. Sanford has completed all the requirements for the degree of Ph. D. at Northwestern with the exception of the dissertation.

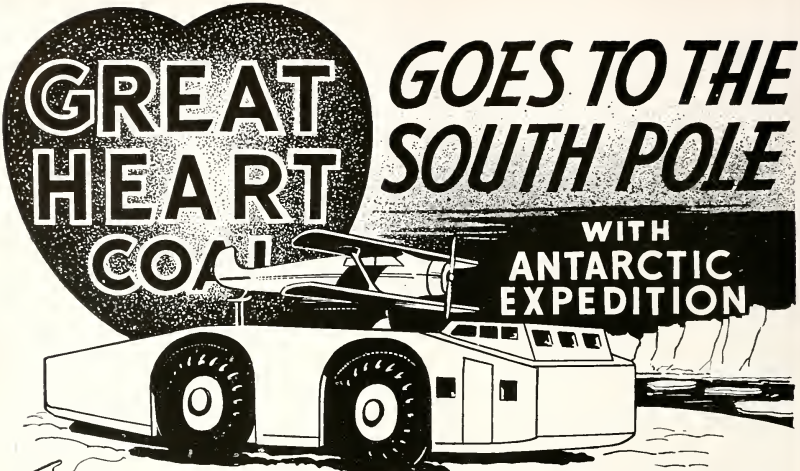
MELVIN L. SCHULTZ, Instructor in Chemistry, obtained his undergraduate and graduate education at the University of Chicago. He received his B. A. degree in Chemistry in 1934, and the Ph. D. degree for which he is now working is to be in the same department. The research for his dissertation involves an investigation of the effect of an intense centrifugal field, of the order of magnitude of $5 \times 10^5 - 10^6$ g, on the rate of radioactive decay of a number of artificial and natural radioactive substances. In addition, Mr. Schultz has participated in a search for an effect of such fields on various types of optical spectra. He has studied some of the aspects of atmospheric radio-activity and has done work on the absorption spectroscopy of solutions of rare-earth salts.

PAUL ROBERT TRUMPLER, Instructor in Mechanical Engineering, graduated from the Easton, Pennsylvania High School in 1932, and from LaFayette College in 1936. He has the degree of B. S. in Mechanical Engineering.

At Lafayette College he was awarded the Traill Green Mathematics Prize, and the Fraser Prize in Metallurgy. He also delivered the Salutatory and Scientific Oration for his class. He received his Ph. D. degree at Yale in 1940, majoring in Mechanical Engineering. He is a member of Tau Beta Pi, Sigma Xi, Phi Beta Kappa and the American Society of Mechanical Engineers.

Dr. Trumpler has been a Test Engineer for the Rinek Cordage Company, a Research Engineer for Westinghouse Electric and Manufacturing Company, and an Assistant in Calculus at New Haven Junior College. He has conducted research on Dam Models, on the Effect of Grain Size on Fatigue Strength of a Low Carbon Steel, on the Theory of Fatigue Failure, and on the Strength of Rope Knots.

MERIT P. WHITE, Assistant Professor of Civil Engineering, obtained his Grammar and High School education in Massachusetts and California, and graduated from Dartmouth College in 1930 with the degree of C. E. He was a student at California Institute of Technology from 1931 to 1935, receiving the degrees of M. S. and Ph. D. His experience has included assignments as Junior and Assistant Engineer, and Assistant Engineer in the Soil Conservation Service, and he has worked in the Hydraulic Research Laboratory at the California Institute of Technology. He has also been Research Associate at the Graduate School of Engineering at Harvard, and a Research Fellow at the California Institute of Technology. Dr. White's special field of interest has been in Structures, Fluid Mechanics and Vibrations, the latter particularly in connection with the effects of earthquakes on buildings. He is a member of Sigma Xi, Phi Beta Kappa, Gamma Alpha, The American Society of Civil Engineers, and the Seismological Society of America.



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In selecting coal for heating and cooking at the base camps of the new Byrd Antarctic Expedition, the scientists in charge sought uncommon qualities.

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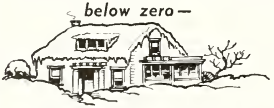
The extreme necessity of eliminating useless weight, called for coal with the least possible moisture and ash.

Space limits demanded a long burning quality to minimize the number of tons needed. And the south pole temperatures ranging to 80° below zero, certainly required rich, flexible heating power!

These requisites could be obtained in no ordinary coal. They stood for quality of the very highest order. It is therefore a clear tribute to the outstanding worth of GREAT HEART that it was approved and selected for the use of the expedition.

qualities prized for heating and cooking in temperatures to 80° below zero—



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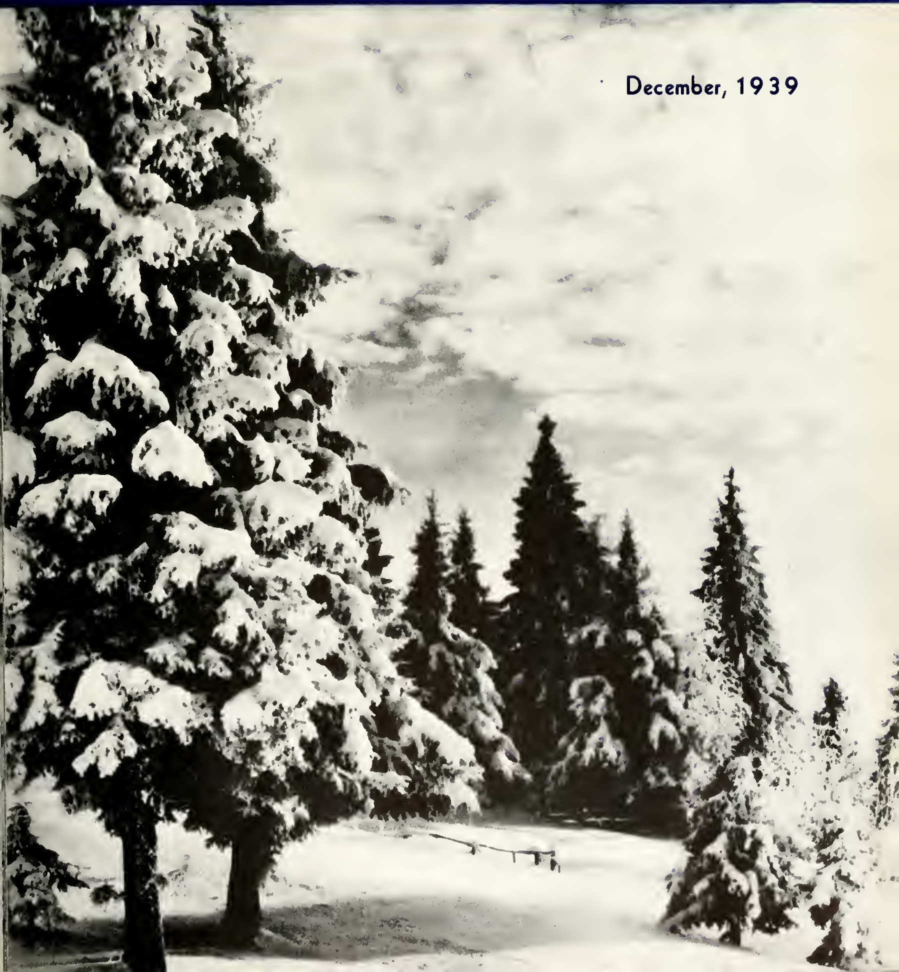
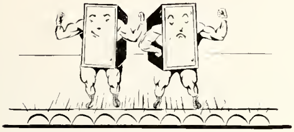
ARMOUR ENGINEER
AND ALUMNUS



December, 1939

G-E Campus News

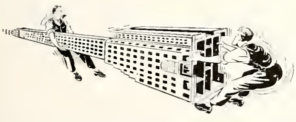


CONQUERING HEROES

TWO newcomers to the G-E family of electric products took the stage recently and proved to 250 industrial, utility, and railroad guests that they could "take it." The pair were oil-less circuit breakers, designed for applications heretofore limited to oil-type breakers.

As are all their brethren, these breakers are designed to protect electric circuits, interrupting those circuits when the current rises to a dangerous level. One of the pair operates magnetically. The other uses high-pressure air. As they should have been, the actual circuit interrupting tests in themselves were properly uneventful. The breakers passed them with ease—even though one test exceeded their interrupting ratings by 50 per cent.

Among those present were three distinguished ex-Test men—E. O. Shreve, Iowa State '04, G-E vice-president in charge of apparatus sales; M. O. Troy, Virginia '96, commercial vice-president and head of the Central Station Department; and D. C. Prince, Illinois '12, head of the engineering department, G-E Philadelphia Works.

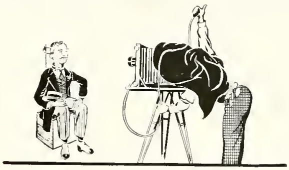


SKYSCRAPER STRETCHERS

NEW YORKERS who have the tallness of their city's skyscrapers neatly cataloged in their minds will soon have some mental reorienting to do. General Electric engineers are stretching the towering G-E building in midtown Manhattan.

The actual stretchers are four 25,000,000-candlepower searchlights of a type recently introduced by General Electric. Each contains three "midget suns"—1000-watt water-cooled mercury lamps the size of a cigarette. Four of these searchlights are being mounted so that they will send their streaks of bluish-white light up the building's corners, accentuating the structure's vertical lines and creating an illusion of greater height. Under favorable atmospheric conditions the beam will be visible high above the tower.

Thus, G-E illuminating engineers, some of whom only recently completed the Test Course for engineering college graduates, continue to introduce new methods of illumination. Other examples of their work can be seen in all parts of the nation—on highways, buildings, city streets, athletic fields, and hundreds of other places.



SIT STILL, PLEASE!

SOME photographic subjects are the perfection of immobility, but not so the subjects of W. K. Rankin, G-E engineer. He photographs electric arcs, the flashes of electricity that occur when a circuit is broken.

Before he could photograph these arcs, Mr. Rankin had to catch up with them. He designed what is believed to be the world's fastest camera—capable of taking 120,000 pictures per second. The fast-stepping arcs occurring in various types of electric apparatus can now be more closely studied and the product itself improved.

In making the camera it was found undesirable to use glass lenses. Therefore, the pinhole principle was used, employing 1000 holes of .01 inch diameter through which light passes to the film. The camera is its own darkroom, being surrounded by a case large enough to house its operators.

GENERAL ELECTRIC

90-194C

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ARMOUR ENGINEER
AND ALUMNUS

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ARMOUR AND LEWIS UNITE

ARMOUR Institute of Technology and Lewis Institute, each with nearly fifty years of honorable record, have entered into an agreement to combine to form the Illinois Institute of Technology. In the new organization, the backgrounds and the reputations of the two component colleges are recognized by the use of the names Armour College of Engineering, for the division of engineering, and Lewis College of Science, for the division of science and arts.

The union results in the formation of a center of technological education having about 7,000 students in day and evening classes, the largest school of its kind. Alumni and former students number more than 70,000.

The desirability of this step, the most important in the history of Armour and Lewis since their foundation, was considered carefully and at length by the trustees of the two schools, and the plan for consolidation was adopted by unanimous vote. Representative groups of Armour and Lewis alumni, from classes graduated as far back as 1899, have voted unanimously for resolutions of approval.

During the school year now in progress, there will be little change in programs already under way, but study will be given to the working out of details in accordance with the general principles that have been decided upon. In September of next year the consolidation will take effect, but for a while it will be necessary to operate both the Armour and Lewis plants. Complete development of the plan contemplates the acquisition of a new, well-planned campus, conveniently situated.

The new institution will provide for.

integration of the educational work in the fields of science, engineering, management, and the humanities, now carried on in the two colleges. Both schools will contribute important features to a program superior to what would be easily practicable for either working alone. Control will be by a Board of Trustees of fifty-five members, including all of the present trustees of Armour and of Lewis.

The educational program will have as its basis a foundation of the sciences—physics, chemistry, mathematics, geology, and biology. The engineering curricula will include civil, mechanical, electrical, chemical, and fire protection engineering. An expansion of the work in the division of architecture and applied art now becomes possible through the union of the two colleges and the fact that architects of international reputation have recently been added to the staff of Armour.

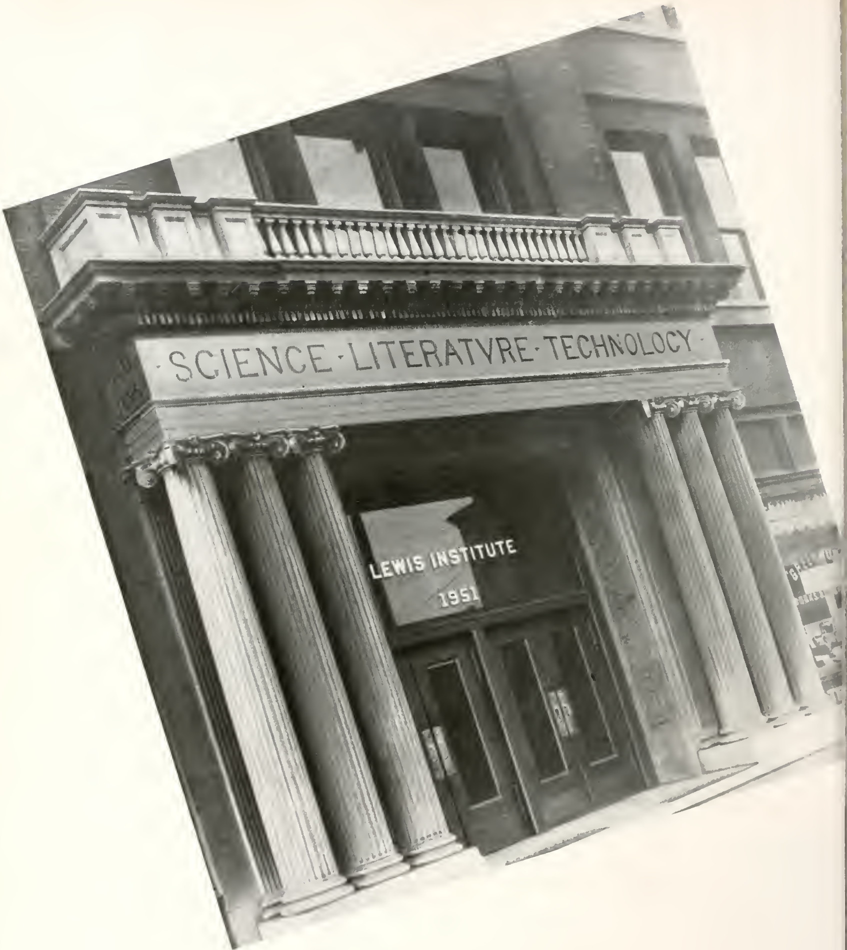
The department of biology already in operation at Lewis will bring added strength to the work in sanitary engineering which has recently been given increased facilities at Armour. A comprehensive program of public health engineering is thereby made possible.

Emphasis will be placed upon industrial management, to meet the increasing demands of industry for men with this training and for research in the field of management and personnel.

The present Armour cooperative course in mechanical engineering will be continued. It is about to enter its fifth year, and has been notably successful, as indicated by the present enrollment of three hundred students who are employed by one hundred and ten industrial corporations in the Chicago area.

The new Institute has had twenty-five years of experience in the teaching of aeronautics and aeronautical engineering. Pilot training now in operation under the sponsorship of the Civil Aeronautics Authority, and research projects sponsored by the National Advisory Committee for Aeronautics, combined with new facilities that will result from the merger, will

Main Building—Lewis Institute



enable the institution to assume an important position in teaching and research in aeronautics.

One of the most important functions of the new school will be to provide greater opportunities for adult education by offering college courses to young men and women who are earning their living. The evening curricula in the adult education division will offer the degree of Bachelor of Science in all the major fields of engineering, arts, and science.

In the Chicago area, the master's degree in engineering has been obtainable only at Armour. This graduate division already enrolls more than four hundred students, and is the second largest in the United States. Increased emphasis will be given to

(Turn to page 45)

LEWIS INSTITUTE

By

FRED A. ROGERS

IN THE latter part of the Gay Nineties, I was stationed in a university town in the southeastern part of the state of South Dakota. Having partly lived down the depression which occupied most of the Nineties, I journeyed to South Dakota because I had heard that this particular town was about to construct an electric power-plant and thought myself qualified to undertake the job, provided I could get it. I later found that I was, and finished the installation in good time. I became rather tired of the twelve-hour day then in effect in that part of the country and decided to look around for another position. A friend of mine who was located in Chicago at the time wrote me that there was about to be built in that city a private institution of learning, and informed me that I might be able to get a position there if I wished to make a change. Up to that time it had never occurred to me to attempt a teaching job, but I was more or less fascinated with the idea and decided to try it out if I was fortunate enough to be selected for a position in the new school.

One rainy week-end about the middle of October, I was visiting some friends on a farm about thirty miles away from this university town, and on Saturday night, long after dark, two men appeared and asked for me. These men had driven all the way from town in a two-horse buggy to inform me that a telegram had arrived summoning me to Chicago. It is needless to say that at that time there were no automobiles and no roads in South Dakota over which automobiles could run if there had been such conveyances. Furthermore, telephones in the country were unheard of. Early the next morning we started for town, over roads that were hardly more than trails, and swimming with mud and water; we arrived toward evening of the same day.

I arrived in Chicago on the following Wednesday morning, and I was told to go to the corner of West Madison and Robey Streets where the school was located. Arriving there, I found a magnificent new fire-proof building built of gray stone and brick, six stories high, with the legend over the entrance carved in the stone, SCIENCE, LITERATURE, TECHNOLOGY, and under that the name LEWIS INSTITUTE painted in letters of gold in the glass panel above the doors. I was very much impressed with the appearance of the building, and began to study the surroundings. I noted that there was a double-track street-car line on Madison Street running east and west, to and from the city. I also noted that when one was near the tracks there was a peculiar singing noise issuing from them. I learned that this was a cable line on which ran two or three-car trains pulled along by a cable underneath the tracks. There was also an electric line running north and south on Robey Street. This was a single-track road having switches for passing at intervals, and the cars were the old-style four-wheel trolley cars operating about ten minutes apart. There were two elevated stations on two different elevated lines within a quarter of a mile of the school, the elevated and surface lines providing very good transportation. About half a mile to the east was Ashland Avenue, a north and south boulevard, which at that time was considered the "gold coast" of the West Side, many

Dr. George Noble Carman
for Forty Years
Director of Lewis Institute

prominent families residing there. There were good residential districts to the north, south, and west also. Madison Street had been paved many years before with cedar blocks. These blocks had at that time partially disappeared so that in rainy weather there were many mud holes at least a foot deep in the streets.

Upon entering the building, I discovered the entrance to be lined with Tennessee marble and the floor tiled with an appropriate and attractive pattern. I found that the student body consisted of students in all grades from the beginning of the high school through the first two years of college. I understand Lewis Institute was the first, at least in this section of the country, to introduce a junior college and "tie it in" with a high school. The students were superior in appearance and were well-bred, although some of them were not especially brilliant scholastically. However, most of them came from good families and had good backgrounds. The faculty consisted of a group of capable men and women, all eager to cooperate with the management. I cannot remember ever meeting a finer lot of people.

Besides the regular departments usually found in schools, there was a Home Economics Department which at that time went under the name of Domestic Science or Domestic Economy. In connection with this department, a cafeteria was operated at which students and faculty members could buy their noon-day lunches. Both the Domestic Economy Department and the cafeteria were entirely new to me and to others also, judging from the number of visitors who came to inspect them. A gymnasium was provided with a full-time athletic director. Early in the history of Lewis Institute, a football team was formed, and the outstanding game of the year was with Armour Institute of Technology. Students and faculty alike went to these games in big tally-ho coaches drawn by four horses and had a jolly time, win or lose. Lewis Institute also boasted in those days a basketball team which at one time was able to defeat at least one of the Big Ten teams. It also "went in" for track, baseball, field-day sports and the like, and was able to compete favorably with other institutions of similar rank. Gradually, however, with changing conditions, which resulted in the enrollment of many part-time students, and the serious nature of the work offered, all athletics, except a limited amount of intra-mural games, have disappeared.

The first director of the Lewis Institute was Dr. George Noble Carman,

Co-Directors of Lewis Institute

Dean Clarke

Dean Rogers

who served as the chief executive for forty years, from 1895 to 1935. Dr. Carman was one of the organizers of the North Central Association of Colleges and Secondary Schools, and was one of the outstanding educators of the United States during his term of office. The Institute grew from a comparatively small beginning to an outstanding college of Engineering and Liberal Arts during his years of administration. The attendance in 1896 was 687 students. By 1936 this number had grown to about 3,300.

The second director was Dugald Caleb Jackson, Jr. who held the office from 1935 to 1938. Since June, 1938, the school has been administered by the Deans of Engineering and of Liberal Arts, Fred A. Rogers, and Clarence L. Clarke.

The Lewis estate, including Lewis Institute, is under the control of a Board of Trustees approved by the Circuit Court of Cook County, and the director reports directly to this Board. The Board of Trustees is assisted by a small group of educators who consult with the Board of Trustees and the director on educational matters. The trustees and the director together with these assistants, constitute the Board of Managers.

The will of Allen C. Lewis, which is the charter of Lewis Institute, was drawn in 1877 and provides for a high-class polytechnic school. When the Institute opened in 1896, this pro-

vision was interpreted, after considerable discussion, to refer to an engineering college as well as a technical high school. To this end engineering was introduced at the very beginning and the degree of Mechanical Engineer was granted to three graduates in June, 1901. Up to the year 1912, the degree of Mechanical Engineer was granted to all graduating engineers, conforming to the example set at an early date by Cornell University. Between 1912 and 1925 the degree of Bachelor of Science in Mechanical Engineering was granted, thus conforming to the then standard practice among American colleges. Since 1925 three degrees in engineering have been granted: namely,—Bachelor of Science in Civil Engineering, Bachelor of Science in Electrical Engineering, and Bachelor of Science in Mechanical Engineering.

In 1903 a second building known as the engineering building was added to the plant; the engineering laboratories were enlarged and the equipment was moved into the new building. This building is also six stories high and conforms in architectural

Mechanical Engineering Students at Lewis

design to the main building. It stands to the south of the main building on Damen Avenue, formerly Robey Street.

As stated above, when the school opened students were received directly from the grammar schools, and were given instruction through high school and two years of college. Three commencement certificates were granted: namely,—preparatory certificates corresponding to junior high school, the academic certificate corresponding to four years of high school, and associate in arts. The last was granted after two years of college work had been completed satisfactorily. The Institute ceased to give preparatory certificates about 1904, the academic certificate about 1920, and the associate in arts certificate (at commencement) about 1930. The degree of Bachelor of Science in Arts and Sciences has been given every year since 1918. All high-school subjects have been omitted from the schedules since about 1920 with the exception of a few courses in elementary mathematics which are still given from time to time in the evening session. The Institute has thus conformed to the standard college for the last twenty years. Lewis Institute has been fully accredited by the North Central Association continuously from the organization of that body up to 1918 as a Junior College, and from then on till the present as a four-year standard college.

From the opening of the Institute down to and including the current year, an evening school has been maintained. In the beginning the evening classes were limited to two ten-week terms, two evenings a week. This arrangement was later changed to four evenings a week and two fifteen-week terms. The same grade of work is carried on in the evening as in the day school, and students may change from day to evening or vice versa, without loss of credit. In every department all the work for a degree may be done in the evening school. There are, however, certain non-credit engineering and shop courses, given in the evening, especially designed for mature students who have neither the preparation nor the time to complete an engineering curriculum.

The type of work which Lewis Institute was carrying on at the beginning of the World War in 1918 made it especially adapted to the needs of the government for training electricians, blacksmiths, machinists, and carpenters for the various arms of governmental service. Shortly after the beginning of the war, a garage was erected and instruction was extended to auto mechanics and continued till the end of the war. Over 1000 men were trained in these courses for the service.

At the close of the war when the government established the Veterans' Bureau for Vocational Rehabilitation, the Institute accepted and trained more than 1,300 men formerly in the service. During the period of the war the Institute was the headquarters of the S.A.T.C. (Students' Army Training Corps) for the Sixth Corps Area.

Referring back to Home Economics, it is my understanding that Lewis Institute was one of the first schools to introduce such a course of training. From what I have learned, I am certain that there were only three or four schools in the country ahead of Lewis in this respect, the first degree in Home Economics at Lewis being given as early as 1912. The cafeteria, although closely related to the Home Economics department, has been operated under a different management for many years, and has served both day and evening students by providing noon-day and evening meals. The Home Economics department is now and has been from the beginning one of the outstanding departments of the school and has provided teachers and dietitians for hospitals, schools, tea-rooms, and other commercial institutions throughout the country.

Director Carman was interested in all branches of education and did not believe in a strictly polytechnic or engineering school without accompanying work in liberal arts. He believed that the engineer should interest himself in English, economics, psychology, and the like, as well as in purely technical subjects. Furthermore, the Institute is located near the medical center of the West Side of Chicago, and he saw the opportunity to draw students who were qualifying to enter the professional schools of medicine, dentistry, pharmacy, and law. It is then quite logical that pre-professional work for students is offered in the fields of medicine, law, pharmacy, dentistry, nursing, and laboratory technique.

Business and economics is offered for those who wish to specialize in this direction. This course includes accounting, personnel work, merchandising, advertising, salesmanship, and the like. Adult education has received considerable attention for non-degree seeking adults who wish to pursue a given field of study for business or personal reasons. An education department serves many young people who wish to become teachers, and arrangements are made for practice teaching by Seniors in the department. The psychology department has become very prominent and maintains a well-equipped up-to-date laboratory and psychological museum, both of which have attracted wide attention.

The art department includes the study of interior decorating, clothes designing, color theory, and that part of ceramics which applies to art. The work in ceramics at the present time is largely research investigation.

The engineering department includes a section devoted to metallurgy and metallography. This section gives a number of courses in both metallurgy and metallography which are especially adapted to the needs of men working in the steel industries and others who are interested in non-ferrous alloys. These courses are especially well attended in the evening school.

In electrical engineering, Lewis Institute has been a leader in Chicago in the specialized subject of Illumination. Many students in electrical engineering have continued to work in this field after graduation.

The school year is divided into three quarters of twelve weeks each for the day school, two terms of fifteen weeks each for the evening school, and a summer session of ten weeks. Each class meets a total number of hours of either 60 or 120 per term depending upon whether the course is a single or double-hour period. Each course carries a credit of one major which is the equivalent of three and one-third semester hours.

The tuition is uniformly $20.00 per course regardless of the number of courses taken. This is readily translated into a cost of $6.00 per semester hour by dividing twenty by three and one-third. The maximum number of courses that can be taken at any one time by any student is four.

Referring again to transportation, the cable system on Madison Street has long since been abandoned and the road electrified, as you all know. At the present time, Madison Street has the best transportation and the most modern cars of any street in the city. The name of Robey Street was changed some years ago to Damen Avenue, and the single-track line rebuilt into a modern street railway. The two elevated stations are at the same places as in 1896, about a quarter of a mile away. Bus lines operate on Washington, Warren, and Jackson Boulevards, making the school easily accessible from all parts of the city. The running time from the Loop is about 15 minutes on street car and bus lines, and even less on the elevated.

SHAKEDOWN CRUISE

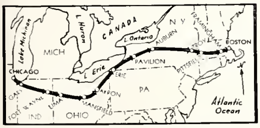
By

FRANCIS W. GODWIN

IN MAY, 1939 all that existed of the world's most unusual vehicle was a bulky file in one of the offices of the Research Foundation of Armour Institute of Technology. This file, like the others adjacent, was crammed with experimental data, notes and calculations, and bore as its only distinguishing mark the label "Project 1-69: Antarctic Snow Cruiser." August saw the project as a set of blueprints. On October 24 in Chicago, workmen swung open the big gates of the Pullman Standard Car Manufacturing Company, and then cut an additional section out of the steel fence with acetylene torches. With two short blasts of its air-horn the Snow Cruiser was driven through the opening, to touch its wheels to the open road for the first time. In twenty-five weeks an idea had become a complex mechanical reality.

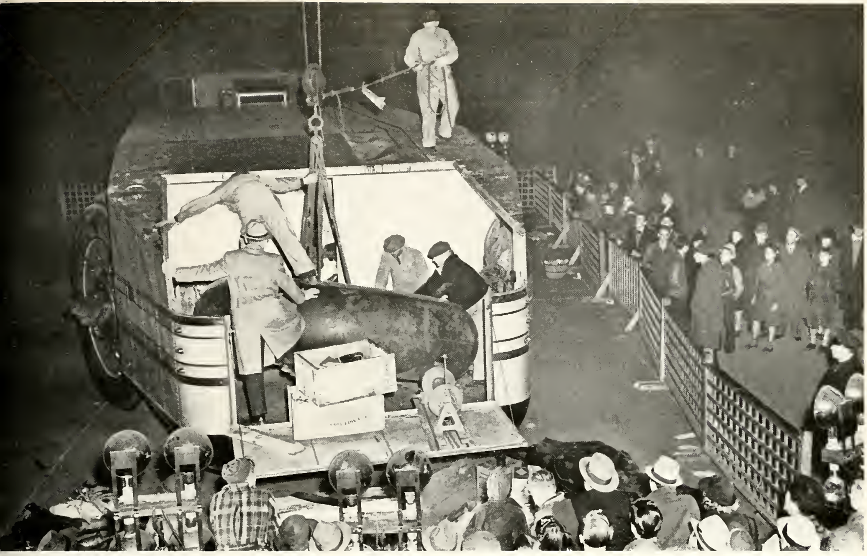
The Snow Cruiser has been built to fulfill an urgent need. With the growth of air traffic and its demand for economical great-circle routes, the expanding scope of meteorological observations, the already indicated vast and valuable mineral deposits, and the thirst for more complete knowledge of how this earth is put together and how we can get the most good out of it, the existence of a totally unknown land as large as the United States could not be tolerated. Numerous attempts have been made to discover what lies in the interior of the Antarctic Continent, and each has been faced with the inadequacy of ordinary forms of transportation. Ships can deliver abundant supplies to the shores in the proper season, but when men push inward to an interior destination they must take with them enough food and necessities to get them there *and back again*. Man-hauled sledges move slowly, cover little ground and exhaust the men. With dog-teams the burden is divided, but so also is the food supply, and again the range is limited. Airplanes achieve distance and speed, but to be worth the effort exploration requires more than merely flying over the land.

Building the Cruiser: Assembling A Wheel Hub and Hydraulic Lift Mechanism



● The initial overland trip of the Antarctic Snow Cruiser, driven by highway under the captaincy of its designer, Dr. Thomas C. Poulter, Scientific Director of the Research Foundation of Armour Institute of Technology, delivering the Snow Cruiser to the motor ship North Star in Boston for its journey to the Antarctic continent.

ADMIRAL BYRD AND THE CREW
Left to right: Ferranto, Wade, Byrd, Meyers, Poulter



Loading Spare Tire and Supplies

Tractors are valuable, but still slow and not quite long-ranged enough. In addition to all this are the deep crevasses, some wide and impassible, others narrower and hidden with a flimsy roof of snow, ready to swallow anything as small as a man, sledge or a tractor.

While serving as Senior Scientist and Second-in-Command of the Byrd Antarctic Expedition II, Dr. Thomas C. Poulter, now Scientific Director of the Research Foundation of Armour Institute, envisioned a vehicle big enough to cross crevasses, flexible enough to get itself out of difficult spots, and powerful enough to carry a crew of four men, an array of scientific instruments, a machine shop, radio station, complete living quarters with food and supplies for a long period, and fuel for thousands of miles of travel. He studied and measured such things as the depth to which a loaded wheel would sink in the Antarctic snow, the coefficient of friction of the snow with rubber and steel and other materials, the width limits of crevasses, and the behavior of lubricants under extreme conditions. Many of these studies were extended later under artificial conditions in the Research Foundation laboratories.

Calculations led naturally to the basic design of the Cruiser. For best performance enormous pneumatic-tired wheels were indicated. Length and width of the vehicle were governed by the demands of stability, maneuverability and the size of crevasses to be crossed. Space requirements of the interior were dictated by the number of men in the crew, the scope of the scientific program and the fuel and supplies which had to be carried. As the finished machine stands, it is able to travel approximately five thousand miles on one fueling and support a crew of four men with food and supplies for a full year. In addition it carries on its back a powerful five-passenger airplane for aerial mapping and for reaching other antarctic bases quickly if necessary. Both plane and cruiser are equipped with strong two-way radio.

When the Snow Cruiser rolled out of the Pullman works there remained one important part of the job to be done. Every new type of machine, be it airplane, automobile, typewriter or nutcracker, must be performance-tested before it can be put to its intended use. This does not mean trying it out for a few hours to see if it runs; it means days or weeks of hard operation until something gives out, then replacing the weak part with a better one and repeating the process. Some engineers call it "getting the bugs out." With a ship it takes the name "shakedown cruise." Whatever you call it, the machine has to go through it before it is ready for action.

LEFT

Mounting One of the Largest Tires in the World

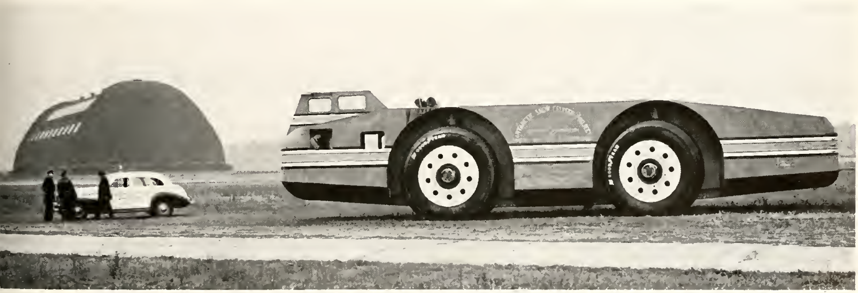
BELOW

The Open Road

The Tires Do Not Sink Into the Loose Sand. The Body Can Be Raised or Lowered Four Feet.

The Snow Cruiser had to have a shakedown cruise, and a good one, if the lives of men were to be dependent upon it on an unexplored continent. It also had to be delivered to Boston in time to go to the Antarctic by boat, and boats can go to Antarctica only in certain periods when the ice is open. The cruiser might have been loaded onto a barge and taken to the coast by water, but this would leave no time for a test trip in this country. Such an arrangement would mean "getting the bugs out" while in the Antarctic, far from sources of supply,

The Cruiser Does Not Need a Garage, But It Rested Overnight in the Goodyear-Zeppelin Hangar in Akron.



and seemed hardly advisable. With time as a factor, only one course remained open. The Snow Cruiser would take to the open road for a shakedown cruise between Chicago and Boston, correcting any possible flaws, making its adjustments, and traveling toward its goal all at once. Federal, state and municipal governments were extremely cooperative. Routes were laid out with attention to every detail. Bridge widths were measured; underpass clearances were checked and rechecked. Although it was intended that the route be arranged to avoid annoying the congested areas, telegrams poured into the Research Foundation from cities asking that the cruiser be brought through the main streets so that the citizens might see it. As many as possible were accommodated.

In the small hours of the morning of October 26th, with Dr. Poulter at the controls and a full crew at their posts, the enormous land ship began its overland journey. In addition to the Snow Cruiser itself the entourage included a pilot car, a one-ton International service truck, several press cars, and a small army of motorized police. Thus surrounded, sunrise found the Cruiser at the Illinois-Indiana line for the changing of the guard.

Just on the outskirts of Gary, only a short distance off the highway, was a region of loose sand. Here, months before, patient search had disclosed a set of conditions which, except for temperature, more clearly approached those of the South Polar snows than did any of the real snow to be found in this country. To this spot the Cruiser went at once. Here was the real test of the mass of calculations that went into its design, for if the machine could travel smoothly on this loose surface its behavior in the Antarctic was assured.

Crowds appeared from nowhere, milling about with the sand pouring into their shoe-tops. Police and highway maintenance men produced ropes and opened a clearing. Cautiously at first, like a bather feeling the water, the Cruiser ran a wheel into the sand. It hardly made a track. Then with confidence and a cheer from the crowd, the ship ran all four wheels into the dunes and maneuvered about toward a steep sand bank. It was decided that the bank—about a twenty-five per cent grade—would provide a chance to set the motor resistors.

Dr. Poulter aligned the Cruiser for a head-on climb and approached the grade. It was quickly seen that the bank rose so sharply that the nose and tail of the ship would touch the ground. Cameras were aimed from all sides, and many were lowered in astonishment when with a turn of a control valve the Snow Cruiser raised its nose four feet above the ground to avoid the bank. Using only one of the engines Dr. Poulter ran the machine up the bank more and more steeply until the stall position was reached, and meanwhile down in the engine room resistance settings were adjusted. The whole process was repeated with the other engine. Finally, to satisfy the crowd who didn't care about resistance settings but wants a show, Dr. Poulter applied both engines on part-throttle and climbed the bank to the limit of a line of trees at the top.

Taking the road once more the convoy was increased by several newsreel cars, their cameras mounted on their roof platforms and making pictures as they rode. In the other convoy cars and in the Cruiser were newspaper correspondents and cameramen. One photographer aboard the cruiser carried a basket of carrier pigeons which he released from the roof from time to time with his latest pictures.

Efficient highway control made good traveling. With the Snow Cruiser bowling along at about twenty-five miles per hour, police cars strung themselves out ahead in pairs. Oncoming traffic was waved to stop at the side of the road. Highway department men stationed themselves at intersections to close feeder roads for the moment, and police cars in the rear held the following cars back at a safe distance. Police riding only a few yards ahead of the Cruiser concerned themselves with keeping back crowds of pedestrians who surged forward into the road. At reasonable intervals the Cruiser and convoy pulled aside and parked for a few minutes to allow passage of such traffic as might be in a hurry to get past, although in these instances it was found that the greatest portion of the traffic was not going anywhere but was out to see the Cruiser.

Cities were a greater problem. News that the Cruiser was coming was a signal for dropping anything and rushing out. In most cases schools were dismissed, and frequently stores and offices were closed. Streets where parking was normally forbidden were lined solidly on both sides with cars, leaving very little room for the Cruiser at the time when it was needed most. Thousands of people jammed the streets and police often had difficulty in clearing the necessary path. Sometimes the convoy was forced to stop entirely until ropes could be thrown up and an opening made. City and State police struggled together to keep people at a safe distance from the big wheels. Individuals and groups would break through the lines and write initials on the Cruiser or attempt to unscrew pieces for souvenirs, and so many headlight parts and wingnuts disappeared that it was necessary to modify their construction to make their removal impossible. It was all in good spirit, but a little difficult at times.

The "bugs" which the crew were awaiting began to show themselves for correction while crossing Indiana. The troubles were confined to the hydraulic system controlling the various actions of the wheels, and lay almost entirely in the failure of sections of defective hydraulic cable. These sections, of course, would not oblige by failing all at once, but insisted on bursting one at a time. As each piece went out the Cruiser was halted while a replacement was installed, the operation taking the best part of an hour, including the time required for clearing the crowd before moving on.

Approaching Warsaw, Indiana, after sundown the advance cars found a highway bridge none too wide in appearance. This bridge had been measured, to be sure, and was on record as wide enough to accommodate the Cruiser. Leaving nothing to chance, nevertheless, a steel tape was produced. Clearance between the bridge girders checked at a half-inch over twenty feet. All was well, then, provided the hub-caps were removed. Wrenches flashed in the moonlight and the four caps, each as big as a steel washtub, disappeared temporarily into the storage compartment. This left the comfortable margin of one and one-quarter inches on either side between hub and bridge. Plenty of room if you took it cautiously. It took several hours and wore out a lot of flashlight batteries, but didn't scratch the bridge.

Columbia City, Indiana, produced one of those street conditions which make the average Snow Cruiser driver worry. Cars were parked tightly along one side, with a big truck projecting from the line. The opposite sidewalk was packed solidly with men, women and children overflowing into the street for a better view. Brakes were applied, and Dr. Poulter took his choice. The truck scraped off two Cruiser hub-caps.

The halt to arrange for the slight damage to the truck was an excellent opportunity for some inspection. Occasional particles getting into the hydraulic pressure pump indicated

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PROGRESS IN MUSIC

By

EARLE L. KENT

MUSIC has been relatively inactive compared to the other arts in taking advantage of the vast resources of information and devices that have been made available in relatively recent years. While motion pictures, photography, drama, communications, and practically all other fields of human endeavor have been setting a pace of ever-increasing momentum with color film, intricate stage sets, radio, television, and endless other developments, music has plodded along with comparatively no changes in its instruments.

When the horse and buggy was the popular means of transportation few people felt there was a need of anything better or even dreamed that anything better was possible. But now that we have automobiles, fast trains, and airplanes few people could conceive doing without them. Many believe today that the traditional instruments of music are good enough and that improvements are unnecessary if possible. However, if one examines the exponential growth of published literature, patents, and commercial enterprises in the field of electronic musical instruments during the past ten or fifteen years it is evident that there is a trend toward bringing music in step with the progress which is so vital to the other arts.

Before considering some of the deficiencies of traditional instruments and the progress that is being made to improve them it might be well to review some of the fundamentals of tones and tone production.

The character of a musical tone is determined by its pitch or frequency, its intensity or loudness, its timbre or frequency components, and its envelope of manner in which the tone starts and stops. The number of periodic cycles occuring in a second determines the pitch of a tone. Examples are shown in Figure 1-A of a diapason organ tone whose period is 1/440 second, giving it a pitch of A3 and in Figure 1-B of a clarinet tone whose period is 1/220 second, making it sound an octave lower, or A2. The loudness of the tone depends upon the amplitude of the wave. Figure 1-C shows a tone wave whose amplitude gradually builds up as the tone is sounded and gradually diminishes as the tone is released. This is in contrast to the envelope of the tone in Figure 1-D, where the tone starts abruptly at its maximum loudness and then ends abruptly. Tones having these envelopes sound different to the listener because of the transients involved. Whether a string is struck, plucked, or bowed it produces tones of the same general character except for the shapes of the envelopes and of course these tones sound different. The timbre of the tone depends upon the frequencies and amplitudes of various waves that are added together to produce the final wave form. As an example, the clarinet tone shown in Figure 1-B is composed of a number of waves whose frequencies are harmonically related. Considering the fundamental frequency of 220 cycles per second as a wave whose amplitude is 1.00 there is also a third harmonic (660 c.p.s.) whose amplitude is 0.60, a fifth harmonic (1100 c.p.s.) at 0.12 amplitude, a sixth harmonic at 0.07, a seventh at 0.60, an eighth at 0.35, a ninth at 0.40, a tenth at 0.50, an eleventh at 0.13, and a twelfth at 0.10. When all of these waves are added together the wave shown results. The frequency content of a tone may not always consist of frequencies that are harmonically related as is indicated in this example. These frequency components, or partials, may be of inharmonic nature as is characteristic in bells or in wind instruments when overblown. A muted trumpet is a form of a cylindrical pipe closed at both ends and when overblown produces an inharmonic series in the ratio; 1.43, 2.46, 3.47, 4.47, 5.48 and so on.

When the pitch of a tone produced by a musical instrument, or by the human voice, is changed it does not necessarily follow that the partial content of the tone will be the same as it was before the change in pitch was made. In other words the timbre of the tones produced by instruments and by the voice can and does change over the pitch range of the instrument or voice. Due to resonance of various parts of a violin the partials between 2000 c.p.s. and 4000 c.p.s. are prominent and the violin, viola, and cello have different resonant regions causing much of the difference in the tone quality of these instruments though each is producing the same note. The component frequencies between 2500 and 3000 c.p.s. are greatly amplified in the case of a clarinet. Composers and arrangers must not only keep in mind the general characteristic timbre of the instrument for which they write but must also know how the timbre varies in the different registers of the instrument.

The power needed for the production of tones is usually furnished by the musician himself. He is occupied therefore, in some degree, with physical exertion and is not able to devote all his ability to delicate shading or rapid manipulation that would otherwise be possible. It is true, of course,

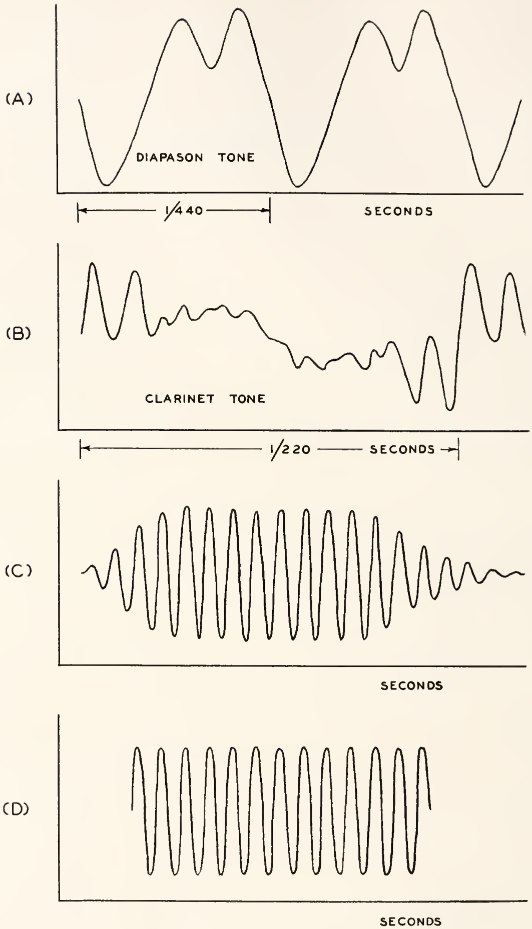

Figure 1

A—Open Diapason Organ Tone

B—Clarinet Tone

C, D—Sine Wave Tone Showing Attack and Release Envelopes

that in the traditional musical instruments the musician puts much of the expression into the music as he blows, scrapes or pounds and maybe the exercise is good for him. However, it seems reasonable that if electrical energy can replace the manpower and if controls can be devised whereby the musician is in complete control of pitch, intensity, envelope and timbre over wider ranges than was ever possible before, music has certainly made a step forward. It is not at all unreasonable to expect the instruments of the future to be electrically operated and all controlled in a more or less uniform manner. Why should the man who furnishes the bass viol tones in the orchestra be cursed with a bulky, cumbersome instrument that he must stand up to play if it is possible to produce the same music by a means much more practicable and flexible? He should be able to put as much speed and delicate shading into his music as does the violinist. Why should a person have to spend a good portion of his life mastering a trumpet and then have to start practically from the beginning if he wishes to play a trombone, or a tuba, or a clarinet? If the instruments were more uniform in their controls and other physical requirements this would not be so true. A person who develops the muscles in his lips to play a trumpet would have to redevelop his lips to play a bass horn, as it has a different mouthpiece, and would perhaps ruin his lips for playing the trumpet. Furthermore he would have to learn to read music written in a different code, for trumpet music is written in the treble clef and the bass horn music is written in the bass clef.

Indication that steps are now being taken in this direction is shown in Figure 2, where a conventional bass viol is compared to one whose tones are reenforced electrically instead of by the bulky resonator.

Musical tones may be produced by a purely electric means, such as by vacuum tube oscillators, or they may be generated by some mechanico-electric means in which mechanical motion is needed in conjunction with the electric circuits. Sound recording on film such as is used with motion pictures offers one possibility for the generation of musical sounds, for continuous tones could be recorded in a multiplicity of sound tracks and played at will by the musician. Considerable effort has been made to use this method in a musical instrument but as yet no commercially practicable

Figure 2

Conventional Bass Viol Compared with One Whose Tones Are Reinforced Electrically.

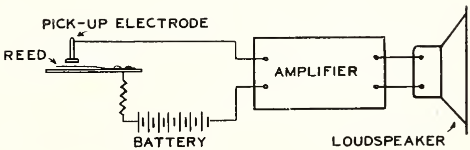

Figure 3

Schematic Diagram of a Brass Reed Used in Electronic Tone Generation.

Figure 4

Cloister Model Everett Orgatron.

instrument has been produced. Figure 3 illustrates how a vibrating reed may be utilized in a mechanico-electric method of tone generation. The motion of the reed with respect to the pick-up electrode causes an electric wave to be created in accordance with this motion. If the reed vibrates at 440 c.p.s. the electric wave will be of the same frequency and it is amplified by vacuum tube amplifiers and passed on to the loudspeaker. The loudspeaker is a motor-like instrument that causes a diaphragm to vibrate in accordance with the electric wave applied to it and the moving diaphram creates the sound that reaches the ear.

The pipe organ is the grandest of all musical instruments because of its wide range of power, variety of tone

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Figure 5

The Ansley Dynatone, an Electric Piano, Radio, and Phonograph Combined.

VALVES: THE OPEN SESAME TO MODERN LIVING

By

H. L. DELANDER

MOST OF us recall the old Arabian tales of Ali Baba and the forty thieves, whose mystic call, "Open Sesame" was the only key that would open the door of their secret cave. There is an "open sesame" today to control all of our material requirements—comforts, conveniences, pleasures, and profits—without which we would go back through the centuries and live as cave men again. This modern key which unlocks our storehouses of daily food, shelter and clothing, is the handwheel of a valve, multiplied, of course, countless numbers of times.

It may be said that the original and most important valve in history is the human heart—a living force pump which propels the blood through the blood vessels and maintains circulation throughout the body. From birth to death this valve works unceasingly, day and night, opening and closing from 65 to 100 times a minute. And when it ceases to function, life, also, ceases. Of course the heart has no handwheel, as it operates automatically, the same as a check valve which works with the direction of fluid flow and acts as a stop valve in reverse flow, thereby not requiring a handwheel, but all other man-made valves must be provided with a means of operating them, and the handwheel is by far the most common. That is why we say that the handwheel of a valve is the "open sesame" to modern living.

Everybody Uses Valves

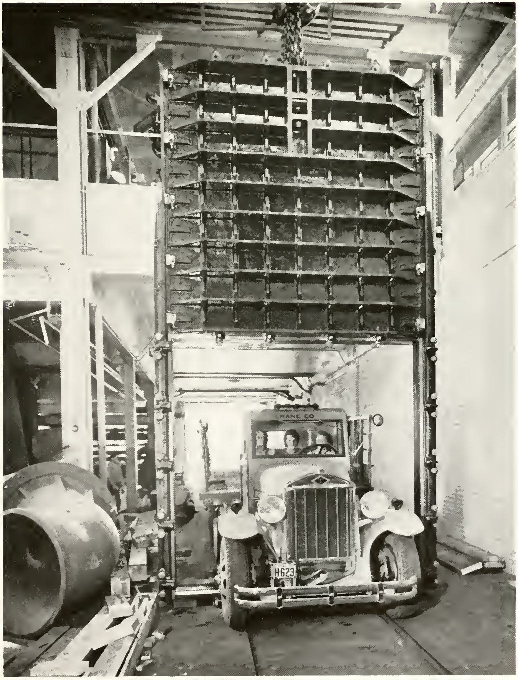
Every time we turn a faucet to get water for drinking, cooking, bathing, or any other purpose, we open a valve. The same thing happens when we turn on the gas in the kitchen range, the spigot on the cider barrel, the lever at the soda fountain, the pump at the filling station, or the air hose to inflate our tires.

The largest man-made things on earth, such as our great dams and reclamation projects, giant ocean liners, towering skyscrapers, deep tunnels, and mining operations, oil wells, vast municipal water supply, and sewage disposal plants—all are made possible and are controlled to a greater or lesser degree by valves of all kinds, all sizes, all shapes, all strengths.

A motor car couldn't run without its engine, which, in itself would be useless without the valves. In fact, all systems of transportation—locomotives, buses, ships, airplanes—are dependent upon their valves to feed and control their motivating energy.

The most recent exploit of unusual valve service is on the giant antarctic snow cruiser invented and constructed

Nine-foot Square Iron Service Gate for Water Works and Sewage Disposal Service



(Johnson's Studio)

by Dr. Thomas C. Poulter, Scientific Director of the Research Foundation of Armour Institute of Technology in Chicago. This monster motor vehicle is now on the high seas on its way to the South Polar regions. Installed in the pilot's cab are some twenty small high-pressure steel valves which control the hydraulic mechanism on each wheel.

Manufactured products of all kinds—the food we eat, the clothes we wear, the things we use in our daily activities—are the result of many operations, processes, and movements made possible by the opening and closing of valves, VALVES, VALVES.

Ranging in size from openings almost as small as the diameter of a needle, to yawning gateways large enough to permit a circus giant to walk through without bending his head, valves are made in an infinite variety of sizes and shapes and materials.

Some of them are as intricate in construction as a watch; some are well-nigh human in their behavior; some are almost indestructible in service, defying the extremes of heat and cold and pressure. They are on duty in all parts of the world—in factories, homes, hotels, hospitals, public buildings, in mines beneath the earth, in pipe lines in and on the ground, in ships at sea and in the air. In cities, towns, farms, plains or deserts, wherever man has gone, valves will be found because man cannot get along without them.

Above:

Six-inch, 1500-pound Alloy Steel Toggle-Operated Angle Stop-Check Valve.

Below:

General Utility Brass Globe Valve.

Basic Types of Valves

While there are countless varieties of valves, basically they may be reduced to three fundamental types—the cock, the globe valve, and the gate valve. The cock, which is the simplest kind of valve dates back to the Roman era when bronze cocks were used to control the flow of water in conduits. The essential difference between cocks, gate valves, and globe valves is that in the valves the discs lift out of the path of the matter passing through them, whereas in the cock, an opening in its plug when turned to coincide with an opening in its body and the connecting pipe provides a channel for matter to pass through.

In modern industrial piping, however, the gate and the globe valve types are most frequently used on account of their flexibility in service. Proper selection and installation, of course, are of the utmost importance to valve service. Assuming that valves are installed correctly, there are several fundamental qualities that all

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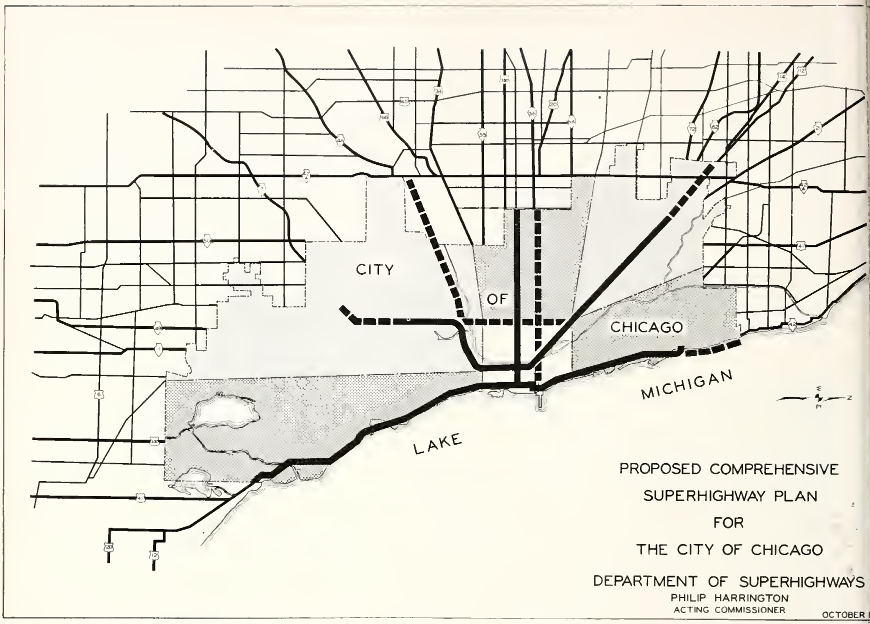
Group of 66-inch Iron Gate Valves



THE CHICAGO SUPERHIGHWAYS

AS part of the current efforts to provide Chicago with adequate and modern local transportation facilities, officials of the City of Chicago recently developed and proposed a plan for a comprehensive system of superhighways providing 62.2 miles of routes costing an estimated $205,000,000.

A broad outline of a physical and financial program was submitted to the City Council on March 1, 1939, by Mayor Edward J. Kelly. Subsequently the financial program was enacted into legislation, and a Department of Superhighways was created by the City Council.

Mr. Philip Harrington, Commissioner of Subways and Traction, was appointed Acting Commissioner of Superhighways. Under his direction and supervision, more detailed plans for the comprehensive system of superhighways were developed and were proposed to the City Council by Mayor Kelly on October 30, 1939.

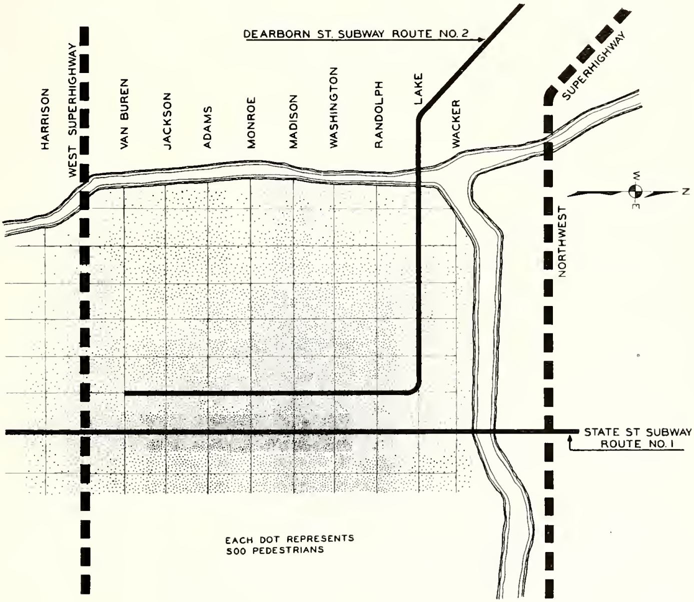
Assisting Mr. Harrington in the preparation of the plans were Charles E. DeLeuw, Consulting Engineer for the City; William R. Matthews, Engineer, Department of Public Works, and A. J. Schafmayer, Engineer, Board of Local Improvements. Public hearings are now being arranged by Alderman George D. Kells, Chairman, Committee on Traffic and Public Safety of the City Council.

The necessity of developing superhighways coincident with modernization of local street car, elevated and bus lines, their proposed merger into a unified company, and the construction of Chicago's initial system of subways, is self-evident.

Numerous studies in recent years have proved that a solution of the local transportation problem would be but a halfway measure without accompanying solution of the problem of handling passenger automobile and truck traffic.

The greater portion of Chicago's existing street system was laid out for horse and buggy travel. It subjects through traffic to all of the interference from pedestrian and vehicular cross traffic and parking of vehicles, and is neither safe nor adequate.

Its shortcomings have long been



PRESENT PEDESTRIAN ACTIVITY
IN CENTRAL BUSINESS DISTRICT
AND
RELATED LOCATION OF SUPERHIGHWAYS AND SUBWAYS

OCTOBER 1939

known, and various attempts have been made to correct the glaring deficiencies. In the nine years from 1930 to 1939, the City, the County of Cook, and the State of Illinois have built a total of 240 miles of highway at a cost of approximately $27,000,000.

With a single exception these improvements were highways at grade. While adding much to the highway facilities of the City, these additions have failed to remove congestion and have contributed little or nothing to a reduction of the high and increasing death toll resulting from the hazards of mixed traffic.

For instance, there were 17,231 traffic accidents in Chicago during 1938, resulting in 686 fatalities and the injury of 20,719 persons. Analyses of accident ratios on various types of thoroughfares show the worst record on such streets as Cicero Avenue, South Parkway, Ashland Avenue and Western Avenue, three of which are streets carrying mixed traffic, including street cars, in large volume.

The traffic accident rate was as high as 189 accidents per 10,000,000 vehicle miles, as compared with the rate of 8 accidents per 10,000,000 vehicle miles on the grade-separated portions of the Outer Drive.

Furthermore, the intermingling of all types of traffic with cross traffic streams intersecting at every street corner has resulted, recent surveys disclose, in a reduction of average over-all speeds between the downtown district and points near or at the city limits to below twenty miles per hour, and in some cases to twelve or fifteen miles per hour, especially during the morning and evening rush-hour periods

Undoubtedly the greatest contributing factor to the city's vehicular traffic problem, aside from its great number of narrow streets, is the rapid growth in the use of passenger automobiles and trucks.

Not more than thirty years ago, the automobile was a novelty on the streets of Chicago. In 1909, for instance, there were only 5,500 passenger automobiles in Chicago, and a total of only 305,950 in the nation.

By 1915 there were 35,218 automobiles registered in the city, or one passenger car for every seventy inhabitants. Today there are 508,900 automobiles in Chicago, or considerably more than there were in the nation in 1909. The ratio of automobiles to inhabitants has increased from one for every seventy residents to one for every seven persons. Automobile registration is still increasing at an average rate of 2.7 per cent per year.

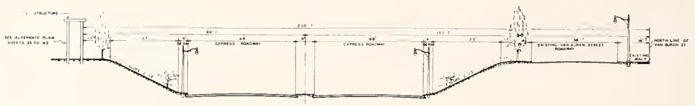
Mr. Thomas H. MacDonald, Chief of the Public Roads Administration, Federal Works Agency, accurately describes conditions existing in Chicago in a report he recently submitted to President Roosevelt in developing the necessity for Trans-City Connections and Express Highways in large urban centers.

In it, Mr. MacDonald declared in part:

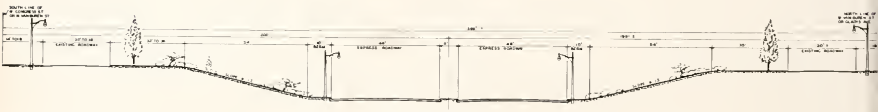
"Some measures of relief are imperative, and the only course that promises a really satisfactory solution is the provision of adequate facilities for conduct of the heavier entering traffic streams through the city at or near its center, and on to appropriate exit points.

"The nature of the facilities required will depend upon conditions peculiar to each city. In some cases redesign and widening main highways and connecting city streets may suffice and may be feasible; although on rural highway sections involved, widening should always include physical separation of the opposing traffic streams, and any widening in the downtown area of cities is certain to be beset with difficulties.

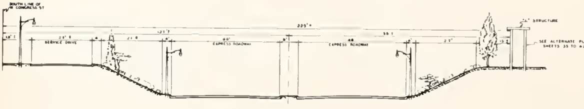
"In the larger cities generally only a major operation will suffice—nothing less than the creation of a depressed or an elevated artery (the



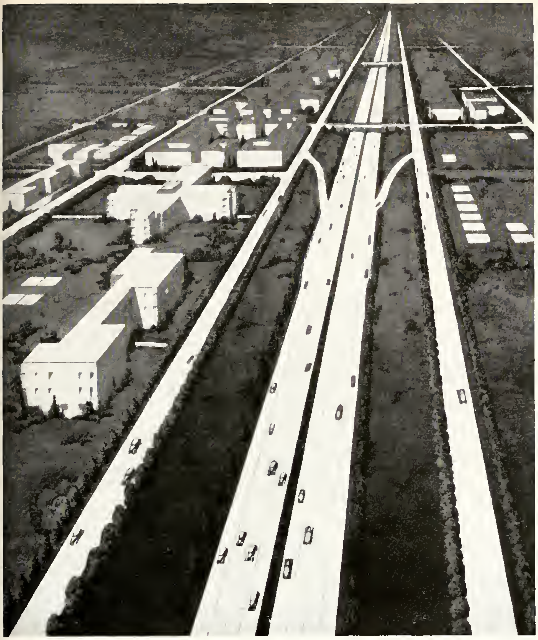
TYPICAL CROSS SECTION
SACRAMENTO BLVD TO HONORE ST



TYPICAL CROSS SECTION
CENTRAL AVE TO KEDZIE AVE



TYPICAL CROSS SECTION
MARSHFIELD AVE TO LOOMIS ST



Perspective of Proposed Development Between Garfield Park and Columbus Park.

former usually to be preferred) that will convey the massed movement pressing into and through the heart of the City, under or over the local cross streets without interruption by their conflicting traffic. Such facilities are not required in any city for the service of through traffic alone. They are not required solely for the service of the traffic entering the city from typically rural highways. There usually is added to these streams in the outer reaches of the city or its immediate suburbs a heavy movement of purely city traffic that mounts to high peaks in the morning and evening rush hours. Movements of this latter sort largely follow the same lines as the traffic entering the city from main rural highways simply because the peripheral city areas and suburbs in which they are generated have developed along such highways.

"Whether the needed facility be a trans-city connection or an express highway, or whether the traffic to be served includes large or insignificant contributions from extra-city highways, in either case the nature of the traffic within the city is much the same.

"It always is largely a movement from the periphery to the center of the city, and is little concerned with intermediate sections, but it must pass through them and, in so doing, is obstructed more or less frequently at the cross streets. The congestion that results, under present conditions, is due in part to the usually inadequate width of the existing artery and in part to conflict with cross traffic, generally complicated by parked vehicles.

"Reference has previously been made to the leap-frog-like movement of traffic from the periphery of cities over intervening areas to their centers. The motor vehicle itself is the primary cause of this phenomenon. It made possible the outward transfer of homes of citizens with adequate income from the inner city to the suburbs and it now conveys these citizens daily back and forth to their city offices and places of business.

"The former homes of the transferred population have descended by stages to lower and lower income groups and some of them (each year an increasing number, generally those nearest the center of the city) have now run the entire gamut. Almost untenable, occupied by the humblest citizens, they fringe the business district, and form the city's slums—a blight at its very core! Each year a few of these once prouder tenements, weakened by want of repair, tumble into piles of brick, not infrequently taking a human life in their fall. Each year a few of them make way for parking lots—unsightly indices to needed facilities of higher dignity! Each year the city 'takes over' a few of them for unpaid taxes. And now—the Federal Government is beginning to acquire them in batches in connection with its slum clearance projects. Heralds of a better future though they are, these acquisitions comprise one of the reasons for avoidance of delay in dealing with the problems of trans-city connections and express highways.

"Another reason lies in the fact that, here and there, in the midst of the decaying areas, substantial new properties of various sorts are beginning to rise—some created by private initiative, some by public.

"There is a growing danger that these new properties, sporadically arising, and the more compact developments by the Government in its slum clearance projects, will block the logical projection of the needed new arteries into the city center. Since the actual accomplishment of such projects will at best require time they should now be planned in order that their eventual courses may not be barred by newly created property."

The function of the superhighway is to provide for safety and rapidity of movement. It should be located

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ACCOMPLISHMENTS IN THE GRADUATE DIVISION

By

L. E. GRINTER

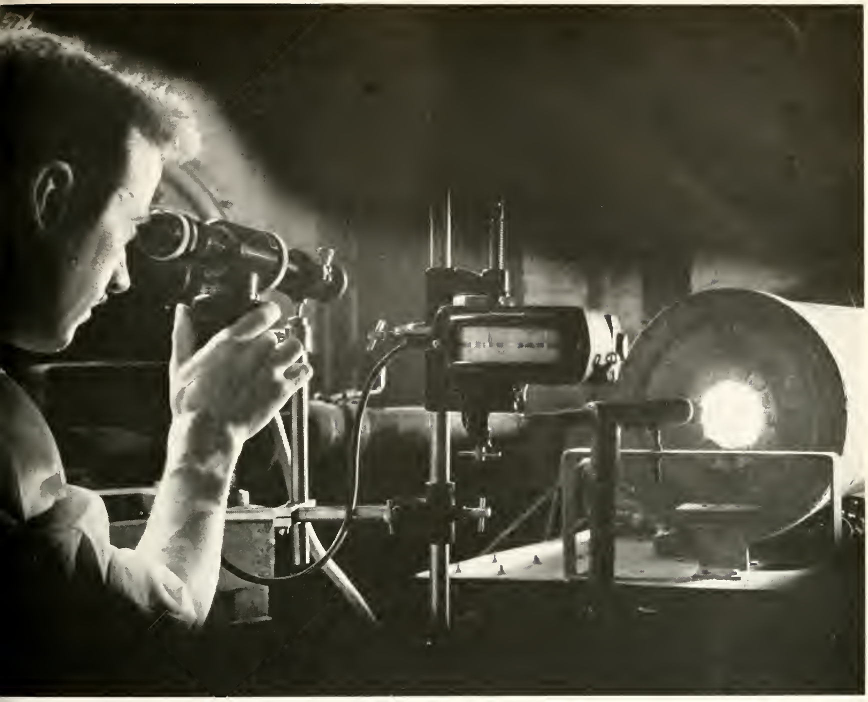
Working Model of Water Filtration and Treatment Equipment

THE graduate work at Armour Institute of Technology represents the most recent of the Institute's educational ventures. Graduate courses in a few instances have been offered for as long as five or six years but an organized program of graduate study was not made available until the second semester of the year 1936-37. From a dozen graduate courses, the program of graduate work in the day and evening has now developed to a scope represented by fifty graduate courses in the present semester. Naturally, the expansion of graduate courses has only followed the trend of registration which is indicated by the present enrollment of 313 evening-school students and 53 day-school students. The difference in number between the day and evening is, of course, explained by the unusual opportunity presented to young men in Chicago through evening-school facilities. Only in such industrial centers is it possible for the young engineer to study for the Master's degree while he is employed by industry.

Apparently young men engaged by industry today have become conscious of the importance of keeping in touch with the development of scientific information. There was a time when industrial leaders discouraged young engineers from graduate study upon the basis that their development was primarily dependent upon the accumulation of practical information. This tendency seems now to have reversed itself and young engineers find that the prestige of an advanced degree has a marked influence upon their advancement.

The development of graduate work in the day school at Armour is dependent upon the success of the Institute's program of obtaining scholarships and fellowships for the subsidization of excellently qualified students. Since it is thoroughly understood that there is essentially a one-to-one correspondence between the number of engineering gradaute students in the United States and the number of fellowships and scholarships made available by the educational institutions for this work, it is clearly evident that the success of the day-school program at Armour Institute of Technology will depend upon the generosity of those who provide scholarships and fellowships for this purpose.

Naturally, the main objective at Armour Institute of Technology remains the undergraduate program. On the other hand, experience at most educational institutions has shown that the strengthening of the under-



Research on the Effect of High Temperatures on Refractory Materials.

graduate program can be accomplished in large measure through the development of graduate work. The teaching of graduate courses and the conduct of research by members of the staff provide a stimulating experience that leaves its mark through the development of enthusiasm and confidence in the teacher. A university carries the obligation of learning as well as of teaching.

Educational administrators also find that the lack of graduate teaching influences greatly the possibility that an institution may retain upon its faculty men of unusual distinction in all fields. Leaders in undergraduate education are also, in the main, leaders in their professions and such men are usually found to be unwilling to attach themselves to an institution where graduate study and research are absent. Evidently, any institution that expects to lead in the development of scientific knowledge should offer graduate students the privilege of being associated with its research program.

A study of the registration at the Institute in the fall of 1939 produces some interesting observations. It is noticed, for instance, that there are 111 new students and 196 returning students in the evening graduate courses. This is a clear indication that the program of graduate work is being undertaken for the purpose of completing requirements for a degree and that the students will return from year to year until their Master's work is completed. It is significant that the first Master's degrees obtained upon the basis of evening graduate study were granted last June. The Graduate Committee conducted the examinations and found these candidates as well qualified for the degree as were the candidates from the day school. The graduate committee consists of Professors Ford, Freeman, Freud, Grinter, Peebles and Thompson.

It is also of importance that more than ninety-eight per cent of the stu-

dents listed in evening graduate courses are college graduates, fully qualified to carry these advanced courses for credit. Of course, nearly all of these students have obtained the Bachelor of Science degree although there are six holding the Bachelor of Arts degree. Twelve students already have the degree of Master of Science and three hold the degree of Doctor of Philosophy.

About two-thirds of the students registered live in Chicago, the remainder being from the adjacent suburbs.

More than ninety-five percent of the evening graduate students come from the following accredited institutions:

Agricultural and Mechanical College of Texas
Armour Institute of Technology
California Institute of Technology
Carnegie Institute of Technology
Case School of Applied Science
College of the City of New York
Colorado School of Mines
Colorado State College of Agriculture & Mechanics
Cornell University
Drexel Institute of Technology
Duke University
Georgia School of Technology
Harvard University
Iowa State College
Johns Hopkins University
Louisiana State University
Massachusetts Institute of Technology
Michigan College of Mining and Technology
Michigan State College
Missouri School of Mines
Montana State College
Newark College of Engineering
New York University
North Carolina State College of Agriculture & Engineering
Northeastern University
Northwestern University
Oklahoma A. & M. College
Oregon State Agricultural College
Polytechnic Institute of Brooklyn
Purdue University
Rose Polytechnic Institute
South Dakota State School of Mines
State University of Iowa
Swarthmore College
Syracuse University
Tufts College
University of Alabama
University of Arizona
University of Arkansas

Research in the Chemistry of Petroleum.

University of California
University of Cincinnati
University of Colorado
University of Illinois
University of Kentucky
University of Michigan
University of Minnesota
University of Oklahoma
University of Rochester
University of Wisconsin
Vanderbilt University
Virginia Polytechnic Institute
Washington University
Yale University

It is evident that students who have graduated with distinction from such institutions are fully qualified to accomplish graduate work of the highest caliber.

Certain graduate courses given at the Institute have created rather unusual attention. The course in Petroleum Refining, offered by Mr. W. C. Edmister of the Standard Oil Company of Indiana, has had an unusual registration for the past three years. It is evident that engineers in the field of petroleum refining feel the need for advanced study. Catalysis, because of its association with petroleum refining, has attracted equal attention.

Considerable interest has also been evidenced in the Institute's courses in Plastics. The course in Organic Plastics given in the present semester has a larger registration than had been anticipated and the graduate course in Applied Plastics, which is given in the second semester of the year, has been exceptionally popular. There seems to be a demand for work in this field that will require additional courses.

A course in the Chemistry of Sewage Treatment, taught by Dr. F. W. Mohlman and Mr. E. Hurwitz of the Chicago Sanitary District, has caught attention because of its excellent teaching personnel. The Institute is very happy to have these distinguished members of the Sanitary District attached to its teaching staff. Dr. Mohlman has been appointed Adjunct Professor of Sanitary Chemistry. He is Editor of the Sewage Works Journal and has many other professional distinctions.

Courses in Diesel Engineering and in Industrial Air Conditioning apparently retain their special interest to advanced students. The possibilities for employment in these fields of specialization seem to remain good.

An unusually large registration is found in the course in Engineering Mathematics taught by Professor Lester R. Ford. Professor Ford is attempting to present advanced mathematics in a way that will appeal especially to the engineering student whose interest naturally is in applications. Courses in Differential Equations also have a heavy registration.

A continued large registration is found in the course in Heat Transfer and Insulation taught by Professor Max Jakob. The importance of new information in this field and its influence upon industrial applications naturally explain its popularity with graduate students. The registration is divided about equally between chemical and mechanical engineers.

An unexpectedly large registration was found in the course in Spectroscopy and Atomic Structure. This interest is probably due to the importance of metallurgy in the Chicago area. Naturally, spectroscopy catches the attention of metallurgists since it is the rapid, convenient, and economical means of identifying the metallic elements.

Graduate work at any institution should be centralized in certain special fields in which the staff is peculiarly competent, and since research is so closely associated with graduate study, it is evident that graduate courses should, in the main, represent the fields of research interest among the faculty. Certain groups of research workers are already represented in the faculty of Armour Institute. A special group in Advanced Mechanics and its applications to structural design and machine design represents a concentration of exceptional strength in research. There are eight or ten men at the Institute now engaged in research in these related fields. Naturally then, graduate work in the field of Advanced Mechanics and its applications will be strongly emphasized. This includes much work in Advanced Elasticity, Vibrations, Elastic Stability, Structural Design, Machine Design, Aeronautical Design, and other associated branches.

A second group, smaller in number, is interested in the general problem of heat flow and heat transfer and its application to special mechanical and chemical design problems. It is felt that the number of teachers working in this field of research should be increased as the Institute adds teachers to its staff.

Thoughts in regard to other research groups involve work in Electricity and in Public Health Engineering. Particularly in the latter field, it seems that an adequate staff can be drawn on a part-time basis from the various city departments and from similar organizations in the Chicago area. This is fortunate in that the opportunities to expand the Institute's ability to serve the community can be enhanced in this way beyond the normal expectation set by financial limitations.

The organization of the new Illinois Institute of Technology will offer the opportunity for an expansion of the graduate program and of the reasearch facilities now available at Armour Institute of Technology and Lewis Institute. Only in the Chicago area where the development of graduate work has proceeded slowly in comparison with the evident demand is there still an opportunity to produce a graduate school of technology second to none in the country. The importance of industry in the life of the city points clearly to the need for research services and scientifically trained personnel that can only be furnished by a graduate school of the highest possible quality, within the area. It will be the objective of the new institution to meet this evident demand.

SPRING CONCERT

O. GORDON ERICKSON, Musical Director, announces that the Musical clubs of Armour Tech will present the fifth annual program at the Goodman Theater Friday evening, March first. The clubs are well-balanced and are fortunate in having a number of fine soloists. The concert this season promises to be outstanding.

WE LOSE A FRIEND

WE are sorry to report to the Alumni the death, on December second, of Charles Edward Eustice of the class of 1901. Mr. Eustice took his degree of Bachelor of Science in Electrical Engineering. During practically all of his business life he was associated with the Galena Manufacturing Company of Galena, Illinois, a company which was founded by his father. For almost twenty years he was president of the organization. Mr. Eustice was a brother of Alfred L. Eustice of the Class of 1907, a member of our Board of Trustees.

THE ARMOUR RELAYS

By
JOHN J. SCHOMMER

WITH the coming of winter, colleges and universities throughout the nation begin to center their athletic interests inside the fieldhouse, on the basketball court, in the swimming pool, and on the tan-bark. Of all the indoor sports, one of the most fascinating, one of the most stamina-trying, and one of the oldest, is the track and field meet.

At about the time when this article appears, hundreds of young men, and some young women, will be listening to the sage words of track and field coaches in preparation for grueling runs, jumps, hurdles, and the like. Of these many hundreds, we at Armour shall be watching and speculating about the ability of some four hundred who will be contestants in the TWELFTH ANNUAL ARMOUR TECH RELAY GAMES; four hundred of the best that the middle west has to offer; four hundred young men whose hearts will be set on winning glory for their colleges and for themselves.

As in past years, Armour, during the latter part of March, will be the center of track and field interest in the United States. Originally a triangular meet for the University of Chicago, the University of Illinois, and Armour Tech, the contests now attract entries from more than forty colleges and universities, many of which boast of athletes of world renown. But all of these boasts mean nothing without proof—so, let's take a look at the files, and dig out some records which have been smashed during the past few years.

Outstanding among brilliant feats was in the one-mile open; a record shattered to smithereens by Wisconsin's small, dark, unpretentious-looking Chuck Fenske. It was in 1938, when the Games seemed destined to be rather mediocre, that Fenske came pounding into the back stretch to ring up a blasting mile-time of four minutes, eight and nine-tenths seconds, still the fastest mile in the history of indoor track in the United States.

But let's stop here a moment to get clearly in mind the purpose of the relays. It was planned, twelve years ago, to establish a meet, a relay carnival, at which the smaller colleges could compete against the universities, with all the advantages of a closed college meet, and none of the disadvantages of an open university meet. Universities whose budgets and large enrollment permitted the best of athletic plant, coaches, and athletes would be competing against universities in a similar class, while colleges whose athletes and facilities were less imposing would be competing in a class by themselves. But on the other hand, when a smaller school could produce one or more athletes of outstanding ability, they would have an opportunity to compete with men of their own calibre. This was the original policy, and it is still followed. The arrangement provides for competition in two classes—college class and university class. However, should any coach care to do so, he may enter his team or any member of it in the university class, where competition is provided by the best talent in the United States.

We are reminded of 1936, when Wisconsin was dominating the pole vault. In that year, Al Haller pushed and pulled himself over the bar at a height of thirteen feet, six and three-fourths inches to hang up a record, while Lloyd Siebert, an aspirant from little North Central College, went home, disappointed but undaunted, with second-place honors, when his pole broke in the attempt to equal Haller's mark. In 1937 the story was different, and here is where the basic policy of the Relays makes for a more interesting and exciting meet. Siebert, coming from a small college, but permitted to compete in the university class, kept grinding away toward perfection of his pole vaulting, and in this year he led Haller a merry pace over the bar to take first place honors and establish a record of thirteen feet, eight and five-eighths inches. Again in 1938 Wisconsin came to the fore with Milton Padway, who also broke the record, only to have his mark shattered in 1939 by young Edward Thistlethwaite of Northwestern. Incidentally, this was the year in which Fenske was making his bid to beat the record of the perennial favorite and grand old man of the track, Glenn

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THE MIDWEST POWER CONFERENCE FOR 1940

THE UNIVERSITY Representatives of the Midwest Power Conference met in Chicago on October 26 and considered the arrangement of a program for the 1940 meeting. The dates have been set definitely as April 9 and 10. The Conference will be held in the Palmer House and will be composed of technical meetings, two joint luncheons arranged in cooperation with local sections of the technical societies, an inspection trip to a manufacturing company in the Chicago Area, and the annual banquet.

The subjects opened for discussion will be those indicated on the tentative program which follows:

TUESDAY, APRIL 9

9:30 a. m.—Registration, Palmer House, Chicago.
10:15 a. m.—Opening Meeting.
 Address of Welcome
 Response for the Cooperating Institutions.
10:45 a. m.—Power Fallacies
11:30 a. m.—Gas Turbines
12:15 p. m.—Joint Luncheon with Local Societies.
2:00 p. m.—Small Power Plants
 (a) Diesel Units
 (b) Steam Units
 (c) Discussion
3:30 p.m.—Electrical Transmission
 (a) Protection of High Voltage Lines
 (b) Bus Arrangements and Switching
 (c) Discussion
3:30 p. m.—Power - Process
 (a) Paper Mill
 (b) Refinery
 (c) Chemical Plant
6:45 p. m.—Midwest Power Conference Dinner

WEDNESDAY, APRIL 10

9:30 a. m.—Fuel Problem of Power Plants
 (a) Coal by stoker
 (b) Pulverized coal
 (c) Oil
 (d) Gas
9:30 a. m.—Hydro Power
 (a) Small and Medium-sized Hydro-Plants
 (b) Operating Problems in a Low-Head Hydro-Power Plant
 (c) The Loup River Development
 (d) Coordination of Hydro and Steam Power
12:00 noon—Joint Luncheon with Local Societies
1:30 p. m.—Bus Leaves for Inspection Trip

The University Representatives of the Midwest Power Conference for 1940 will be as follows:

Dean L. E. Grinter, Vice-President, Armour Institute of Technology.

Professor M. P. Cleghorn, Head, Dept. of Mech. Eng., Iowa State College.

Professor L. S. Foltz, Head, Dept. of Elec. Eng., Michigan State College.

Professor C. Francis Harding, Head, School of Elec. Eng., Purdue University.

Professor H. O. Croft, Head, Dept. of Mech. Eng., State University of Iowa.

Professor O. A. Leutwiler, Head, Dept. of Mech. Eng., University of Illinois.

Professor Hugh E. Keeler, Dept. of Mechanical Eng., University of Michigan.

Professor Ben G. Elliott, School of Engineering, University of Wisconsin.

Dean L. E. Grinter, recently appointed Vice-President of Armour Institute of Technology, found it necessary to be relieved of the directorship of the Midwest Power Conference, and Professor Stanton E. Winston of the Department of Mechanical Engineering at Armour Institute will be the new Director. Professor C. A. Nash, of the Department of Electrical Engineering at Armour Institute, will act as Secretary of the Conference.

A TALE OF TWO TECHS

By

JAMES C. PEEBLES

WITH long gray beard sweeping the page, Father Time made the final entry and prepared to close a huge volume of history entitled NINETEENTH CENTURY. I remember well that newspaper cartoon, for it appeared just at the time when I had my first view of Chicago. Even more clearly do I recall a cold winter day when I was walking along West Madison Street, pushed almost into a run by a buffetting wind out of the west.

There had been heavy falls of snow that winter, and as the merchants cleared their sidewalks it had been piled into great heaps near the curb. As I hurried along, the street was a quiet valley flanked on either side by a mountain range of snowy peaks. As if the supply were unlimited, more snow was falling that morning. Like gulls before a Biscay gale, big snowflakes rode the wind, wheeling from crest to crest on the sierra of snow that lined the street.

All winter long those mountains of snow remained. On one of the highest peaks some wag placed a sign reading SPION KOP. For the Boer war was in progress, and places like Mafeking, Kimberley, Ladysmith, Spion Kop, were much in the news. Names such as Roberts, Kitchener, Cronje, De Wet, were being written on the pages of history. The vaudevillians of the day took great delight in reporting that the Boer soldiers always wore rubber boots, the purpose being to keep DeWet from defeat.

Just a short time before I had dropped out of my country high school rather suddenly, determined to find somewhere a better preparatory training for a college course in engineering. Seeking wider horizons, my high school principal called it. But hemmed in by the snow that wintry morning, any horizon at all seemed a rather futile quest. Soon I reached Robey Street, and stopped for a moment on the corner to study my surroundings. Yes, there it was, my far horizon, just across the street; a large five-story building of gray stone and brick. Carved in the stone above the entrance the words Science-Literature-Technology appeared, easily read in spite of the storm. Thus I saw that the institution to which I had come was devoted to science, both pure and applied, and to the liberal arts. For several moments I studied those three words, indicative of the educational fare I would feed upon. A slice of art between two slabs of science, an intellectual sandwich, a balanced diet it seemed to me. So I crossed the street and entered Lewis Institute for the first time.

Looking back through the years at my student days at Lewis, the scene is indistinct in many of its details. Outstanding personalities however stand out clearly in my memory, while surrounding circumstances and events are recalled but dimly. From

among the clearest pictures which recollection supplies I propose to offer a few, etchings with fading backgrounds, vignettes of memory.

One teacher whom I remember with affection and esteem was a professor of mathematics. Many faculty men have come and gone in my experience since those days, but I have never known one who possessed a keener sense of the importance and high dignity of his calling. On one occasion a vistor, meeting him for the first time, remarked "So you teach mathematics, Professor." "Oh no," he replied, "I teach boys by means of mathematics." A nice distinction it was and for me an illuminating commentary upon his entire philosophy of life.

A lady teacher in the department of history has an important place in my recollections of Lewis Institute, because she cramped my style in a field where I thought I was rather good. History, I knew, had been defined (not by the lady teacher) as a skeleton of cold fact on which there has been engrafted layer upon layer of the warm flesh of honest men's imaginings. So in quiz and examination papers I gave my imagination free rein and produced many a chubby child of fancy. Modern radio programs showing us "History in the Making" give me no thrill at all; I did it forty years ago. But we were supposed to study history, not make it, so the teacher looked upon my efforts with a frosty eye. "Too much flesh and too little bone," she said, and set me to boning over the pages of the text book.

In the English department things went a bit better. We had a professor who looked like Shakespeare but who, to my utter surprise, made us study Milton. He seemed a great admirer of the gloomy poet, and had us working many hours over "Paradise Lost," much of which I hated fervently. It seemed to me that our English professor considered the world had reached its cultural zenith about 1670, and had been slipping a bit ever since. Then one day the professor himself slipped; he gave us the well-known sonnet for just one lesson. Promptly I forgave him, and Milton, too, for all the weary hours that had gone before. But with this reservation; if any more long, lugubrious poems had to be studied, the class could do it without me. I would only "stand and wait."

In the machine shop we had an instructor whose hands were two scientific instruments. His touch was so delicate that he could measure the diameter of a metal rod to a thousandth of an inch with an ordinary caliper. He could throw a double-throw switch in an electric light circuit with such speed that the lights never blinked. At the county fair back home I had seen the artist who kept repeating the refrain "The hand is quicker than the eye." Here was an actual demonstration and it set me to thinking that perhaps the shop instructor had chosen the wrong profession. Years later Cook County bought a number of voting machines, the election commissioners believing that they would save time, reduce errors, and foil the short-pencil artists. But my shop instructor, with no tools but his own hands and a piece of wire, made the machines show any election result that he wished. One machine, after receiving his expert attention for thirty seconds, showed a local option proposal winning in the first ward. That was all for the voting machines.

During my days at Lewis I made frequent trips to the South Side to hear a famous preacher at Plymouth Church. Oratory was in greater favor then than now, and I was greatly impressed. Vivid recollections come to me of a commanding figure, a dramatic personality, a mellifluous voice. I found myself paying little attention to the import of his words, being content to enjoy their music . Here was a consummate artist whose medium was the spoken word.

Later I learned that the great preacher was also president of Armour Institute. Preacher and engineering educator; it seemed an odd combination to me, but evidently it worked because both church and college were thriving. After frequent visits I came to know Armour Institute well, and finally transferred from Lewis to Armour, very largely I confess because of the magnetic personality of the president.

During my early years at Armour it was my good fortune to know many engaging personalities. Prominent among them I recall the dean, whose lectures I attended for more than two years. We never worked hard in his courses but we learned a lot. Out of much study and learning he could distill just a little wisdom and most of us carried some of it away with us.

Now Lewis and Armour have arranged an affiliation, and the two schools which I have known so long and so well will soon be one. And so, *con amore,* I close my portfolio of vignettes. Candid camera and movie film will record their future, but I shall keep my etchings for they belong to the days when both were young.

HELP! HELP! HELP!

In the Placement Department the first repercussion from the current European conflict was the laying off of a number of our engineers. Business enterprises concerned with foreign construction, and others dependent upon foreign sources for raw materials, were forced to reduce personnel. During the first two weeks in September the list of unemployed lengthened. After a lapse, industry found its pace and began absorbing those men who had been laid off as a consequence of the new war.

On the whole, placement has been much more active than it was at this time last year. During September and October of this year sixty placements were made. This number includes permanent, temporary, and part-time positions, but does not include any holiday employment for day students here at the Institute. Twenty-six placements were made in November.

Last month the Department placed an alumnus of 1912 in a position carrying a good deal of responsibility and a salary of $3,200 per annum. This alumnus had kept his placement record *up-to-date.* When the opening materialized, we knew where to look for the man to fill the position.

If you are a combination electrical and mechanical engineer, with a record of achievement behind you, you may be interested in an opening for an engineer who has had some experience in the manufacture of small electrical and mechanical devices. If, in addition to the qualifications previously mentioned, you are of executive material and have a knowledge of design and development, *send in your record.* This opening will not be active until the first of the year.

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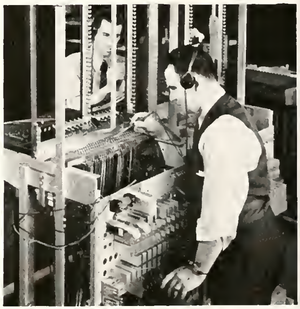
Count on your telephone *in a pinch*

A smell of smoke, a burst of flame—and instinctively you rush to your telephone for help.

Bell Telephone service is reliable for two reasons. The people who provide it are capable. The equipment is well made—Western Electric's part.

At your command is a vast plant—underground. overhead and in central offices—which responds so smoothly that you take it for granted.

It does so because into the production of the 43,000 different items entering into this plant have gone careful thought and skilled workmanship. That's been Western Electric practice throughout 57 years of telephone making.



Count on a Bell Telephone switchboard too, and all the rest of the complex apparatus. Here is shown one of hundreds of inspections which Western Electric makes.

Western Electric *. . . made your* BELL TELEPHONE

FRESHMAN SCHOLARSHIPS

THE thirteenth competitive examination for freshman scholarships, to be awarded to February graduates of public and private high schools, will be held on Saturday, January sixth, at the Institute. Five awards will be made, carrying full tuition for the second semester of 1939-40 and the first semester of 1940-41. Awards will be based upon the scores in the competitive examination, the record in high school, the extra-curricular activities, and the general fitness of the candidates, a personal interview with each candidate by a member of the scholarship committee being required as part of the examination.

Prior to 1933, it was the custom to allot one scholarship for the freshman year to each of the Chicago city high schools. It having been decided in 1932-33 that this plan was unsatisfactory, the present plan for awards by competitive examination was developed by a standing committee of the faculty, of which H. T. Heald, then Dean of Freshmen, was Chairman. One hundred thirty-seven candidates participated in the first competition held in May, 1933; the number of participants increased year by year, and over three hundred took the examination in May, 1939. Ten one-year full tuition scholarships have been awarded each year in May. Beginning in January, 1935, a similar competition was established for February graduates from public and private high schools for the award of five one-year scholarships. About fifty candidates took the examination in January of 1935, and about eighty in January of 1939. Coincident with the offering of February scholarships, a plan was worked out whereby a student entering in February might, by taking a full-time program in the summer session next following, complete his degree program in three and a half years.

A survey of the academic careers of recipients of freshman scholarships reveals evidence of the success of the plan, a great majority of scholars having attained distinction in both scholarship and student leadership.

The current freshman scholarship committee is led by Professor S. E. Winston, who was a member of the original scholarship committee; it includes seventeen members of the staff, who, with one or two exceptions, also serve as advisers to freshmen.

C. A. Tibbals.

A NEW MATHEMATICS TEXT

ELEMENTARY Theory of Equations. By W. V. Lovitt, New York, Prentice-Hall, Inc., 1939. 11 + 237 pp. 40 figures. $2.50.

After graduation many engineers begin to appreciate what mathematics is meaning to them and feel the necessity for further study. This is particularly true of persons whose work or interests bring them into contact with equations. Lovitt's book is well designed to be of great help to those individuals. While it is intended for students who have had only one semester of analytic geometry, engineers, who have taken the calculus and usually have had differential equations, will find that they can use this book as a home study course. It lends itself admirably to such a course for many reasons. First of all, a large number of problems are worked out in the text. Secondly, although all problems have answers, many of them are given at the end of the book. This arrangement is the ideal one, since it prevents a student from being too conscious of the answer he is trying to get. Finally, both Horner's method and Newton's method are illustrated graphically, thus following the modern eduactional practice of making a student thoroughly familiar with a mathematical doctrine by studying it from many different angles. This does not mean that anyone can absorb the theory of equations by reading the book as he would a novel. It means that he must use paper and pencil, and he must solve a fair number of problems, just as he would have to do if he undertook the study of any mathematical subject.

One of the outstanding features of the text is the presentation not only of Horner's and Newton's methods, but also of Graeffe's method. It would have been fine if the author had included the methods of successive approximation and iteration, but even so the presentation in one text of these three methods is a great convenience. Horner's method, the old reliable way of solving algebraic equations for real roots, can be used for complex roots, but the work is very laborious. Newton's method is invaluable for solving transcendental as well as algebraic equations for real roots. Graeffe's method is probably the most practical means for solving an algebraic equation which has more than one pair of imaginary roots. The book evidently is designed for the student who has need actually to solve equations.

The development of subject matter is excellent. Since the probabilities are that many students who read the text have not had algebra recently, the book begins with a review of linear and quadratic equations. This is followed by a review of simultaneous linear equations which leads to an introduction to determinants. Binomial equations introduce a review of complex numbers and De Moivre's theorem. The material which follows serves to lay a firm foundation for the solution of equations so that a student may know what he is doing and why he is doing it. Both Budan's and Sturm's theorems are discussed. This is commendable because Budan's theorem frequently is passed over too lightly in standard texts, although it has a definite use in practical applications. The book closes with the usual conventional topics of determinants, symmetric functions, resultants, discriminants and eliminants. The last chapter, which contains ruler and compass constructions, should be called to the attention of angle trisecters who are as much of a nuisance to mathematicians as perpetual motion inventors are to engineers.

Anyone who has occasion to solve equations, or who is interested in their solution, will find this text a very valuable acquisition to his library.

William C. Krathwohl.

NEW TRUSTEES

F. M. DeBeers

L. S. Hardin

Moffett Studio

Franklin M. de Beers, consulting chemical engineer and manufacturers' representative, was born in Chicago, and is a graduate of Armour in the class of 1905. He was awarded the degree of Ch. E. in 1910, and the degree of M. S. in Ch. E. in 1926.

Mr. de Beers was the organizer of the Swenson Evaporator Company, and served as its President and General Manager from 1909 to 1922. From 1922 to 1924 he was Vice-President and General Manager of the Whiting Corporation. Subsequently he was in charge of studies of surplus crop distribution for the Sun Maid Raisin Company, from 1924 to 1926; practiced as a consulting engineer; served as General Sales Manager for the J. P. Devine Manufacturing Company, Inc., from 1930 to 1931; and was Vice-President and Sales Manager of the Leader Industries, from 1931 to 1932.

Since 1933, he has been owner of the firm of F. M. de Beers and Associates, consulting chemical engineers and sales representatives for manufacturers of chemical process machinery.

For many years he has been actively interested in the affairs of the Institute and the Alumni Association, and has given most valuable service.

Mr. De Beers lives in Glencoe. He is a member of Tau Beta Pi, American Institute of Chemical Engineers, American Chemical Society, Chemists Club, Chicago Engineers Club, Skokie Country Club, and Chicago Athletic Association. His favorite recreations are golf and contract bridge.

Louis S. Hardin, lawyer, was born in Charleston, Illinois. He received his B. A. degree at Yale in 1917, and his J. D. degree at the Law School of the University of Chicago in 1921. He was admitted to the bar in the latter year, and practiced law in Chicago with the firm of Cutting, Moore, and Sidley from 1921 to 1924, and with Wilson, McIlvaine, Hale, and Templeton from 1924 to 1927. In 1927 he became associated with Pam and Hurd; he is now a partner in the firm of Pam, Hurd, and Reichman.

Since June, 1939, Mr. Hardin has been General Counsel of Armour Institute of Technology, and has given most diligent and efficient service.

Mr. Hardin lives in Lake Forest. He is a member of Phi Beta Kappa, Alpha Delta Phi, Phi Delta Phi, and the Order of the Coif; of the American, Illinois State, and Chicago Bar Associations; and of the University and Onwentsia Clubs. His favorite sports are golf, tennis, and squash racquets.

A GIFT FROM THE CLASS OF 1912

It is pleasant to record that the class of 1912, more than twenty-seven years after its graduation, retains its appreciation of the fact that the Institute has continuing needs. A college library can never have too many books. The class deposited with John Schommer, one of its own members, a substantial sum of money, and directed him to confer with Miss Nell Steele, Librarian, about its expenditure in the purchase of books. After a careful survey, the following were purchased:

- The Chemical Formulary. 4 v. Chemical Publishing Company, New York, 1933-1939.
- Thompson, Alexander John. Logarithmetica Britannica, Being a standard Table of Logarithms to Twenty Decimal Places. 9 Parts. Cambridge University Press, London, 1934-1939.

The nine parts of the second work are being bound in one volume. In these books, as in other gifts to the library, suitable bookplates will record the generosity of the donors.

The Institute expresses its thanks.

FROM YEAR TO YEAR
A RECORD OF ARMOUR ALUMNI AROUND THE WORLD

By

A. H. JENS, '31

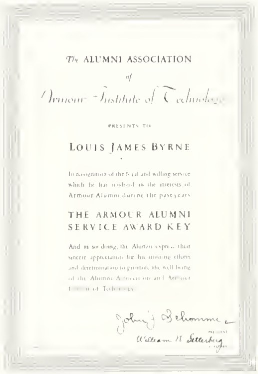
ANNOUNCEMENT of the Armour-Lewis amalgamation was made to the Advisory Board of the Armour Institute Alumni Association, which embraces in its membership all elected past-officers of the association, at the University Club, in Chicago, on Thursday, October 26, 1939. Alumni trustees, members of the Board of Managers and officers of recent graduating classes were also in attendance.

Under the guidance of Alumni President John Schommer the general plan of the consolidation of the two institutions was presented by James D. Cunningham, chairman of the Armour Board of Trustees, Henry T. Heald, president of Armour Institute of Technology and the other trustees present.

Those in attendance, in addition to the above were: J. P. Sanger, M. E. '21; H. W. Munday, C. E. '23; J. B. Johnson, C. E. '11; A. Wagner, E. E. '03; L. J. Byrne, M. E. '04; E. F. Pohlmann, Ch. E. '10; A. H. Jens, F. P. E. '31; H. C. Rossing, C. E. '32; W. F. Sims, E. E. '97; E. Voita, Arch. '24; W. N. Setterberg, Arch. '29; B. S. Carr, Ind. Arts, '15; C. W. Burcky, E. E. '27; W. C. Brubaker, M. E. '06; F. A. Lindberg, E. E. '01.

J. B. Swift, E. E. '01; J. A. Whittington, Ch. E. '14; F. D. Cotterman, M. E. '36; R. N. Vanderkieft, M. E. '39; S. M. Lillis, Ch. E. '34; E. F. Wagner, Ch. E. '38; E. R. Cole, F. P. E. '18; A. S. Alschuler, Arch. '99; J. M. Byanskas, M. E. '16; L. E. Davies, M. E. '19; W. T. Dean, E. E. '00; F. M. de Beers, Ch. E. '05; A. L. Eustice, E. E. '07; R. A. Goppelschroeder, F. P. E. '16; E. O. Griffenhagen, C. E. '06; R. B. Harris, M. E. '02; R. M. Henderson, E. E. '02; L. Hirsh, Ch. E. '14; F. G. Heuchling, Ch. E. '07; R. J. Koch, C. E. '13; J. W. McCaffrey, Ch. E. '22; R. H. Rice, E. E. '97; W. H. Rietz, F. P. E. '15; O. A. Rochlitz, E. E. '01; E. M. Sincere, Arch. '12; W. S. Taussig, E. E. '03.

(Turn to next page)


The ALUMNI ASSOCIATION
of
Armour Institute of Technology
PRESENTS TO
LOUIS JAMES BYRNE
THE ARMOUR ALUMNI SERVICE AWARD KEY

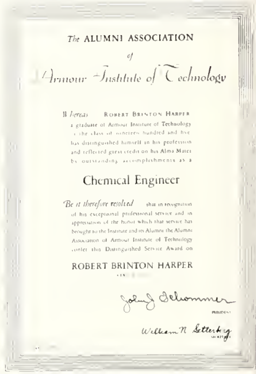
Alumni Service Award Key

For the fifth time since 1932 the Alumni Association has awarded THE ARMOUR ALUMNI SERVICE AWARD KEY. The award this year was to LOUIS JAMES BYRNE for his many years of effort in conducting the Alumni Association's student loan program. Previous awards were to:

JOHN J. SCHOMMER, Ch. E. '12.
HAROLD W. MUNDAY, C. E. '23.
CHARLES W. HILLS, JR., E. E. '11.
DAVID P. MORETON, E. E. '03.

Each of these men had made valuable contributions in promoting the well being of the Alumni Association.

Mr. Byrne is a graduate of the Class of 1904 in Mechanical Engineering. He was recently elected to the Board of Managers to fill the unexpired term of Phillip Harrington. He was also a member of the Board of Managers from 1915 to 1918.


The ALUMNI ASSOCIATION
of
Armour Institute of Technology
Chemical Engineer
ROBERT BRINTON HARPER

Distinguished Service Award

One of the highest gifts that may be awarded by the Alumni Association is the DISTINGUISHED SERVICE AWARD which like the Service Key was given for the fifth time this year. For his outstanding work in the field of gas engineering the name of ROBERT BRINTON HARPER is added to the impressive list of recipients of this award. The list follows:

FRANCIS G. PEASE, E. E., '01, for outstanding work in the field of astronomy.

HOWARD L. KRUM, E. E. '06, for outstanding work in developing the Teletype.

ALFRED S. ALSCHULER, Arch. '99, for outstanding work in architectural design.

CLARENCE W. MUEHLBERGER, for outstanding work in the field of toxicology.

For many years Mr. Harper has been a member of the Board of Trustees of the Institute and has represented Alumni interests in his work on the board. He was president of the Alumni Association from 1927 to 1929.

On November 4, 1939 and again on November 18, 1939, John Schommer met with the Columbus, Ohio group of the Armour Alumni Association. At these meetings, the first of which was held at the Hotel Deshler and the latter at the home of M. F. Davis, F. P. E. '27, the Armour-Lewis program was given full discussion. Columbus does not have a formal Alumni group nor does it have stated times for meetings but as the occasion arises the men rally to the call.

B. G. Anderson, J. S. Tilt, Ed. Swanson, A. J. Danziger, M. F. Davis, R. Windblad, Paul Hendrickson, W. M. Gunther, S. J. McLaren and C. N. Mullican were in attendance.

Mrs. Davis was the hostess at the second meeting.

1897

Tousley, Victor H., E.E., is the electrical engineer for the National Fire Protection Assn., 612 N. Michigan, Chicago, Ill.

1898

Mueller, Fred G., Arch., Partner, Fred G. Mueller-Walter R. Hair, Architects, Hotel Hamilton, Hamilton, Ohio.

Patten, George H., C.E., is Vice President of the Chattanooga Medicine Co., St. Elma Sta., Chattanooga, Tenn.

Nagelstock, Edwin Harry, E.E., is sales engineer for Charles E. Clark Assn., Sixth and Main, Fremont, Nebr.

MacClyment, Harry Alexander, E.E., is the manager and owner of the Lamont Chemical Co., 516 Seaton, Los Angeles, Cal.

Hindert, Edwin George, E.E. '98, was born January 16, 1870, at Minonk, Illinois. He died at Oak Park, Illinois, July 3rd, 1939.

Shortly after graduation in 1898, Mr. Hindert enlisted in Company 3, 2nd U. S. Volunteer Engineers. He was trained at Ft. Sheridan and Montauk Point. He was then transferred to the 17th Co., Signal Corps, at Huntsville, Ala., in October '98, and was sent to Cuba where he was stationed at Marianao. He was mustered out in the spring of 1899.

Shortly after that he was engaged by a firm of consulting engineers for research in the development of appliances for using powdered coal. From 1905 to 1910 he was Chief Engineer of Power Plants, first for the Toledo, Fremont and Norwalk electric road in Ohio and then for the Fort Dodge, Des Moines and Southern in Iowa. Late in 1919 he became operating engineer of the Waukegan plant of the North Shore Electric Co., and worked in an operating capacity with that and its successor corporation, the Public Service Co. of Northern Illinois until he retired in 1931.

He is survived by two sons, two daughters and by Mrs. Hindert. One son, Howard Hindert, is with the Bureau of Aeronautics of the Department of Commerce. Mr. Hindert was a member of Spanish War Veterans, Camp 80, and Veterans of Foreign Wars, Post No. 105.

The above information came through John M. Humiston, a classmate of Mr. Hindert.

1899

Shubart, Benedict, M.E., is a partner of Shubart & Schloss, Machines and Pumps, 521 Boston Bldg., Denver, Colo.

Tarbell, Clarence Lyle, M.E., is treasurer of the Credit Union, John Deere Tractor Co., Waterloo, Iowa.

Matthews, William D., E.E. and F.P.E., is an engineer with the Improved Risk Mutuals, 60 John, New York City.

1900

Sklovsky, Max, E.E., is chief engineer of Deere & Co., Farm Implements, Moline, Ill.

1901

Noble, Alden Charles, E.E., is with the Merchants Fire Assn. Corp. of New York, 45 John, New York City.

Lewis, Walter Irving, M.E., is President of the W. I. Lewis Co., Real Estate, 1206 Citizens Bldg., Cleveland, Ohio.

1902

Shafer, Samuel E., Jr., M.E., is in charge of patent work, Chain Belt Co., Milwaukee, Wis.

Lang, William Haney, M.E., is with the Brady Conveyors Corp., 20 W. Jackson, Chicago, Ill.

1903

Robinson, George Ben., C.E., is Asst. Engineer, Bureau of Streets, Navy Pier, Chicago, Ill.

Strickler, John Franklin, M.E., is Secretary of the Jam Handy Picture Service, Inc., Industrial Motion Pictures and Slide Films, 2900 E. Grand, Detroit, Mich.

Taussig, William Simon, E.E., is Asst. Office Manager of the Visking Corp., 6733 W. 65th, Chicago, Ill.

1904

Strang, Rupert Hurd, E.E., is Superintendent, Light & Water Utility, Public Utilities, Richland Center, Wis.

Coy, Frank Albert, C.E., is a bridge designer, Division of Highways, Springfield, Ill.

The continuation of the program for AN ANNUAL GIFT FROM EVERY ALUMNUS will be, for the present, under the direction of the Alumni Board of Managers. During the years 1938-1939, this work was under the direction of an executive committee headed by J. Warren McCaffrey. The results of Mr. McCaffrey's work show more than 300 contributions totalling in excess of $4,000.00. All of the funds have been used for supplying furnishings for the recently remodeled Student Union Building. It has been decided by the Board of Managers to devote funds collected in the 1939-40 program to the same purpose.

The Board of Managers take this occasion to thank Mr. McCaffrey for the excellent job he did in organizing the first program for AN ANNUAL GIFT FROM EVERY ALUMNUS. It was a difficult task and it was well done.

1905

Clark, Frank Cordley, E.E., is General Manager for the Nitrogen Division of the Solvay Process Company, Chemical Manufacturers, Hopewell, Va.

Willard, Donald E., M.E., is President and Treasurer, Allith-Prouty, Inc., Danville, Ill.

Emmons, Francis Asbury, Ch.E., is vice president, Foote Bros. Gear and Machine Corp., 5301 S. Western, Chicago, Ill.

Harvey, William F., C.E., is with the W. F. Harvey Sales Co., 560 W. Lake Bluff, Chicago, Ill.

1906

Strube, Harry Louis, M.E., is Asst. Chief Engineer, Link Belt Co., 2045 Hunting Park, Philadelphia, Pa.

Fry, August Jether, E.E., is Engineer with the Board of Supervising Engineers, 231 S. La Salle, Chicago, Ill.

Woldenberg, Maxmilian, Ch.E., is President of A. Daigger and Co. and President of Mutual Box Corp., 159 W. Kinzie, Chicago, Ill.

1907

Jarrow, Harry Walter, M.E., is President, Jarrow Products Corp., Refrigerator Gaskets and Insulation, 420 N. La Salle, Chicago, Ill.

Chandler, Fred E., E.E., is General Traffic Manager, Wisconsin Telephone Co., 722 N. Broadway, Milwaukee, Wis.

1908

Odell, Irving, M.E., is Publisher and Editor of the Military & Naval Digest, 11 S. La Salle, Chicago, Ill.

Monahan, Joseph Edward, M.E., is with the Joseph Monahan Co., Machine Tools, 351 Indiana, N. W., Grand Rapids, Mich.

Perkins, Robert Augustus, M.E., Perkins & McWayne, Architects and Engineers, 320 Paulton Block, Sioux Falls, S. D.

1909

Stadeker, Gilbert L., E.E., is Manager, Commercial Refrigerating Dept., Sampson Electric Co., 3201 S. Michigan, Chicago, Ill.

Fitch, Joseph E., E.E., Lawyer, Benson, Fitch & Heinemann, 30 N. La Salle, Chicago, Ill.

Ecklund, Conrad Arthur, C.E., is Senior Topographic Engineer for the U.S. Geological Survey, Washington, D. C.

1910

Bowman, David William, Arch., is Engineer for the Western Precipitation Co., 1016 W. Ninth, Los Angeles, Cal.

Bergbom, Arthur L., M.E., is Instructor in Mechanical Drawing, Roosevelt High School, 3436 Wilson, Chicago, Ill.

Eliel, Robert G., C.E., is with Bradley Machinery Co., 406 Kishawakee, Rockford, Ill.

1911

Nelson, Arthur W., E.E., Owner, Arthur W. Nelson & Associates, Consulting Engineers, 608 S. Dearborn, Chicago, Ill.

Binder, Charles William, C.E., is a draftsman for Standard Oil Co., Whiting, Ind.

1912

Roller, Louis H., E.E., is Manager of the Plant Engineering Dept., P. Ballantine & Sons, Brewers, 57 Freeman, Newark, N. J.

Ruff, John E., M.E., is an Industrial Engineer, Peoples Gas, Light & Coke Co., 122 S. Michigan, Chicago, Ill.

1913

Agee, Robert E., F.P.E., is Assistant Secretary for the Northern Trust Company, 50 S. La Salle, Chicago, Ill.

Kornfeld, Leo P., C.E., is Secretary of the Hamler Boiler Tank Co., Manufacturers of Steel Pressure Vessels, 6025 W. 66th, Chicago, Ill.

Hale, Leonard O., Arch., Salesman, Chandler Co., Pump Manufacturers, Cedar Rapids, Ia.

1914

Bauersfeld, Albert George, Ind. Arts, is Principal of the Irving Park School, 3815 N. Kedvale, Chicago, Ill.

Whittington, James A., Ch.E., is Utilization Test Engineer, Peoples Gas, Light & Coke Co., 3921 S. Wabash, Chicago, Ill.

1915

Adamson, John Friece, E.E., is with Fries-Walters Company, Electrical Contractors, 2001 W. Pershing Road, Chicago, Ill.

Hockenberger, Phil. R., M.E., is President, Becher, Hockenberger & Chambers Co., Real Estate Loans, 2522 Thirteenth St., Columbus, Neb.

1916

Oswald, Arthur A., E.E., is Radio Development Engineer, Bell Telephone Laboratories, Inc., 463 West, New York City.

Steif, Benjamin Leo., Arch., is President, B. Leo Steif & Co., Architects, 919 N. Michigan, Chicago, Ill.

Aarens, Harry Barney, Arch., is a practicing architect, 1609 N. Normandie, Hollywood, Cal.

1917

Smith, Earl Hirst, C.E., is Asst. Chief Engineer, Packard Motor Car Co., 1580 E. Grand, Detroit, Mich.

White, Harold S., M.E., is Development Engineer for Olds Motor Works, Lansing, Mich.

Goldberg, Louis I., C.E., is President, Allied Phonograph & Record Mfg. Co., 1041 N. Las Palmas, Hollywood, Cal.

Conway, Frank Joseph, F.P.E., is a Piping Engineer for the Carrier Construction Corp., Merchandise Mart, Chicago, Ill.

1918

Vogdes, Francis Brooke, E.E., is Sales Engineer, Air Conditioning Dept., Wm. R. Thropp & Sons Co., 163 E. Front, Trenton, N. J.

Broyles, John Lewis, E.E., is an electrical engineer for the Economy Fuse and Manufacturing Co., 2717 Greenview, Chicago, Ill.

Uhlir, Arthur, Ind. Arts, is an elementary school principal, Chicago Board of Education, Foster-Haven Schools, 720 O'Brien, Chicago, Ill.

Sasaki, Tomigoro, M.E., writes in part from Osaka, Nippon, Japan in response to a request from the Alumni Editor, as follows:

Dear Mr. Jens:

I thank you for your letter of August 14. As I am a very bad composer I am afraid I cannot write anything worth reading, especially to be published in the magazine.

We had an especially hot summer this year and no rain. The western part of this country was so dry that it affected the growth of vegetables and fruits, to say nothing of rice fields having dried up, yet this country has enough to feed her people, so we don't have to worry much about these.

I take this opportunity to let you know my new address. My new home is near the seashore, the largest bathing resort in the Orient called Hamadera. During the hot days, from July 1 to August 31, there are millions coming to swim. There are two bathing schools where they teach greenhorns to swim. Besides these, all school children from the 4th to 6th grades primary and 1st and 2nd year middle schools must learn how to swim whether they like it or not, of course, with the doctor's permission. Swimming is included in one of their lessons.

Good luck to you all.

Yours sincerely,

T. Sasaki.

636 Hagoromo, near Hamadera, Osaka, Nippon.

1919

Winfield, Raymond B., C.E., is sales manager, S. W. Nichols Co., Acoustical Correction, 209 Exposition, Dallas, Tex.

Trask, Frederic Allan, F.P.E., recently was transferred from the Pacific Coast office of the Oil Insurance Association to their Chicago office. His home address is Oak Crest Hotel, 1570 Oak St., Evanston.

1920

Throop, Albert R., E.E., is Trunk Traffic Engineer for the Illinois Bell Tel. Co., Room 2001, 212 W. Washington, Chicago, Ill.

Anderson, Homer Ellery, C.E., is with the New York Life Insurance Company, San Francisco, Cal.

McCauley, William Taylor, Ch.E., is a Supervisor, Swift & Co., Union Stock Yards, Chicago, Ill.

1921

Newman, Dr. Louis Benjamin, M.E., Physician and Surgeon, Staff of Willard and Cook County Hospitals, 5146 W. 25th, Cicero, Ill.

Hutchinson, James Hobart, Arch., is Financial Secretary for the International Brotherhood of Electrical Workers, 2403 W. North Ave., Chicago, Ill.

Hoven, Alfred Charles, M.E., is with the American Seating Co., Theater and Church Seats, 901 Broadway, Grand Rapids, Mich.

Carr, Gordon S., C.E., is Sales Manager for the Equipment Division of the Packard Electrical Division, Warren, O.

1922

Reihmer, Leo Lester, M.E., is Vice President, The Lloyd-Thomas Co., Appraisal Engineers, 4411 Ravenswood, Chisago, Ill.

Walker, Edwin G., M.E., is Asst. Chief Engineer, R. R. Donnelley & Sons Co., Printers and Binders, 350 E. 22nd, Chicago, Ill.

Holmes, Leonard M., C.E., is with the Dayton Power & Light Co., Gas & Electric Bldg., Dayton, Ohio.

Maguire, Robert Reginald, F.P.E., is with the Southeastern Underwriters Assn., 805 American National Bank Bldg., Pensacola, Fla.

1923

Krebs, Manfred B., E.E., is a circuit planning engineer, Commonwealth Edison Co., 72 W. Adams, Chicago, Ill.

Love, Harold G., E.E., is an engineer with Weiss & Neistadt, Architects and Engineers, 343 S. Dearborn, Chicago, Ill.

Walker, Ray Lewis, E.E., is general supt., Claim Dept., United States Fidelity & Guaranty Co., 75 William St., New York City.

1924

Aalberg, John Oscar, E.E., who is Chief Engineer for the R.K.O. Pictures, Inc., writes to the Alumni Office in response to the "Annual Gift from Every Alumnus" program this interesting note: By applying a little arithmetic to the figures contained in your letter of August 8th, I find the average alumnus has contributed approximately \$10.00 to your student union fund.

Being an average alumnus, I am enclosing my check for \$10.00 and thank you for the opportunity of helping.

If I slipped a decimal point let me know.

Farrell, J. Stanley, E.E., is Asst. Chief, Purchase Division, U. S. Treasury, 222 W. North Bank Drive, Chicago, Ill.

Brown, Malcolm Lander, C.E., is Superintendent of Construction, Bureau of Engineering, Madison, Wis.

Marco, Fred J., E.E., is Chief Engineer, Coil Matching Division G-M Laboratories, 1731 Belmont, Chicago, Ill.

1925

Sothern, William H., E.E., is an engineer with the Illinois Bell Tel. Co., 208 W. Washington, Chicago, Ill.

Hibbeler, Alvin F., E.E., is an assistant engineer for the Commonwealth Edison Co., 2233 S. Throop, Chicago, Ill.

Frederick, John R., E.E., is an industrial engineer, Wisconsin Power & Light Co., 500 Public, Beloit, Wis.

Rowley, Charles M., M.E., was elected President of the Association of Mutual Fire Insurance Engineers at its annual meeting in Chicago early in October. Rowley is assistant secretary of the Lumbermens Mutual Insurance Co.

1926

Henderson, Samuel Farrell, E.E., is Motor Design Engineer for the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Kauffmann, William Martin, M.E., is Chief Designer of the Diesel and Gas Engine Div., Worthington Pump and Mach. Corp., Buffalo, N. Y.

Michuda, Leo Lawrence, Jr., C.E., is a partner in Leo Michuda & Son, General Contractors, 10944 S. Michigan, Chicago, Ill.

1927

Figenbaum, Karl, Jr., M.E., is Head of Cost Dept., National Regulator Co., Temperature Regulators, 2301 N. Knox, Chicago, Ill.

Gothard, William W., C.E., is Editorial Director of the Domestic Engineering Publications, Inc., 1900 S. Prairie, Chicago, Ill.

Millott, Arthur Thomas, M.E., is supervisor, General Electric Co., Nela Park, Cleveland, Ohio.

1928

Tully, Alan C., C.E., who represents the Associated Ethyl Co., Ltd. in Melbourne, Australia recently wrote in response to an inquiry of the Alumni Editor that the rush of business due to war conditions preventing his offering any information that might be of interest to his classmates but that such data would be forthcoming when the pressure was released. His letter was passed by war censors.

Scholz, William P., E.E., is Maintenance Engineer of the National Broadcasting Co., Merchandise Mart, Chicago, Ill.

Grosguth, Joseph Jr., Arch., Architect, Garrick Construction Co., 64 W. Randolph, Chicago, Ill.

Menge, Clarence H., E.E., is in charge research sales, Product Research Div., The Murray Corp. of America, Manufacturers Auto Bodies, 7700 Russell, Detroit, Mich.

McDougal, Donald Chester, M.E., is engineer and custodian, Revere School, 7145 S. Ellis, Chicago, Ill.

Henry, Arthur William, Jr., F.P.E., recently became state agent of the Eagle Star Insurance Company with headquarters in the Book Building, Detroit, Michigan. Henry was with the Ohio Inspection Bureau for eight years after which he joined the engineering staff of the Insurance Company of North America. He was stationed in Cleveland for the North America.

1929

Kittler, Milton Joseph, M.E., is in charge of aircraft carburetors, Holley Carburetor Co., 5930 Vancouver, Detroit, Mich.

Kernan, J. Melvin, C.E., is Plant Manager, Cleveland Div., Container Corp. of America, Cleveland, Ohio.

Petters, George A., C.E., is Asst. Sales Manager, The Insulite Co., 101 Park, New York City.

Lucchetti, Anthony Michael, E.E., is in the Engineering Dept. of Bell & Gossett Co., Hot Water Heating Systems, 3000 S. Wallace, Chicago, Ill.

1930

Weldon, Bernard J., F.P.E., is an Engineer and Underwriter with Dulaney, Johnston & Priest, Central Bldg., Wichita, Kans.

Hanke, Edwin William Fred, E.E., is connected with the Allen-Bradley Co., Milwaukee, Wis.

McKinnie, William Palmer, M.E., is Project Engineer for the Curtiss Aeroplane Division of Curtiss-Wright Corp., Buffalo, N. Y.

Dollenmaier, Jack M., E.E., is Sales Representative for the Line Material Co., 617 S. Connecticut, Royal Oak, Michigan.

Ross, Emory B., F.P.E., who is connected with the Duncan Insurance office in La Salle, Illinois, announces that Mary Helene Ross was born on November 14, 1939.

1931

Aukers, Albert John, Ch.E., is a research engineer for the Victor Manufacturing and Gasket Co., 5750 W. Roosevelt Road, Chicago, Ill.

Collins, Robert B., M.E., is a draftsman for the Universal Oil Products Co., 310 S. Michigan, Chicago, Ill.

Drigot, William, E.E., is in charge of installation and service for the Air Conditioning Corp., 444 Lake Shore Drive, Chicago, Ill.

Eddy, Richard R., F.P.E., announces the arrival of Susan Jane Eddy on November 21, 1939. Eddy is connected with the Home Insurance Co. in Indianapolis.

1932

Poetzl, Ray W., E.E., is a radio engineer with the Gary Heat, Light & Water Co., 435 W. Ninth Pl., Gary, Ind.

Heckmiller, Ignatius A., C.E., is a hydraulic engineer, Dept. of Interior, Geological Survey, 319 Federal Bldg., Indianapolis, Ind.

Davis, Harold Rex, M.E., is Assistant Superintendent of the White Furnace Co., Mebane, N. C.

De Orio, Joseph, M.E., is chief draftsman for Warwick Mfg. Co., Radio Manufacturers, 1700 W. Washington, Chicago.

Linnell, Orville Guy, Ch.E., is in the research dept. R. R. Donnelley & Sons Co., Printers and Binders, 350 E. 22nd, Chicago, Ill.

1933

Gura, Joseph J., F.P.E., was recently transferred to Milwaukee as district engineer for the Federal Hardware Mutuals. He held a similar position in Boston for the same company.

Bottorff, Paul A., C.E., is Chief Engineer and Vice-President of the Trimm Radio Manufacturing Co., 1770 W. Berteau, Chicago, Ill.

Beemsterboer, George Joseph, C.E., is General Contractor and Builder located at 11732 Yale, Chicago.

Bush, Frank Lewis, Arch., is Machine Tool Designer and Engineer for the Illinois Tool Works, 2501 N. Keeler, Chicago, Ill.

Marks, Christian W., M.E., is in the Sales Dept. of the Republic Flow Meters Co., Industrial Instruments and Controls, 2240 Diversey, Chicago, Ill.

Stair, Otto W., F.P.E., writes to the Alumni Office from Knoxville, Tenn., as follows:

Following my graduation in the Spring of 1933, I became affiliated with the Tennessee Inspection Bureau. From 1933 to 1938, I was moved about the State of Tennessee and finally ended up in Chattanooga. In the process of moving, I acquired a wife and now have a two-year-old son who helps make life very interesting at times. I married a dyed-in-the-wool Southerner and she has succeeded in making a Rebel out of me. Of course there are times when the Civil War is fought again, but contrary to history, the South always wins this one.

In 1938, I accepted an offer with the United States Fidelity and Guaranty Co. in the Safety Engineerng Dept. and moved to Atlanta, Ga. After living in Atlanta for about six months, I moved to Knoxville, Tenn. and established an office in that town. At the present time, I am traveling Middle and East Tennessee and generally get home every weekend. I am off the beaten track of the Armour men and it is a rare thing when I run into one.

1934

Schaeing, William G., C.E., is a serviceman for the Minneapolis-Honeywell Regulator Co., Instruments, 433 E. Erie, Chicago, Ill.

Pflum, Raymond John, C.E., is a Naval Aviator, U. S. N., Naval Air Station, Patrol Squadron 14, Norfolk, Va.

Knudson, Warren A., E.E., is Chief Engineer of Specialty Converters, Inc., Silvercote Division, Heat Insulation and Paper Specialties, 161 E. Erie, Chicago, Ill.

Reed, George M., E.E., was recently transferred from the Chicago office of the Fairbanks Morse & Co. to Morton, Ill., where he will act as regional sales engineer.

1935

Radvillas, Charles K., M.E., is a Heat Transfer Engineer, Bureau of Engineering, U. S. Navy, Rm. 2315 Navy Bldg., Washington, D. C.

Armsbury, Richard Dale, Ch.E. is field representative for the Technical Products Department of the Shell Petroleum Corp., St. Louis, Mo.

Jones, Barclay Van Cott, C.E., is a Time Study Engineer, Spiegels, Inc., Wholesalers, 1040 W. 35th St., Chicago, Ill.

Gregerson, Donald Ralph, C.E., is with the State of Illnois Highway Dept., State Highway Bldg., Mt. Hawley Rd., Peoria, Ill.

Youngkrantz, Howard Robert, Ch.E., is a metallurgist, Apex Smelting Co., Aluminum & Zinc Base Alloys, 2556 Fillmore, Chicago, Ill.

Roberts, John Llewellyn, F.P.E., advises that the Roberts' now are the proud parents of Joan Margaret, born June 22, 1939.

1936

Linden, John Edward, C.E., who is an engineer with Charles De Leuw Co. was married on September 2, 1939, to Miss Alice Burton in Chicago.

Scott, John Corrie, C.E., according to information from Detroit correspondents, is to marry Miss Shirlee Karlson in Chicago on January 3, 1940.

Mansfield, Raymond B., E.E., is now an engineer with the Zenith Radio Corp. in Chicago. He was formerly with Cutler-Hammer in Milwaukee. Chicago residence is 5200 Sheridan Road.

Richards, Robert Benjamin, C.E., is a staff engineer with Charles DeLeuw & Co., Consulting Engineers, 20 N. Wacker, Chicago, Ill.

Savage, William Harrison, Ch.E., is with Robert W. Hunt Co., Inspection Engineers, 2200 Insurance Exchange Bldg., Chicago, Ill.

Balai, Nicholas, Ch.E., is an engineer for the Universal Oil Products Co., 310 S. Michigan, Chicago, Ill.

LaPedus, William Edward, M.E., is Chief Draftsman for the Guardian Electric Mfg. Co., 1621 W. Walnut, Chicago, Ill.

1937

Schultz, Paul Robert, Jr., Ch.E., is a graduate student at the Case School of Applied Science, Cleveland, Ohio.

Leason, Fred Lewis, Jr., M.E., is with the Protex Weatherstrip Mfg. Co., 300 W. Adams, Chicago, Ill.

McCaulay, John Francis, F.P.E., inspector with the Fire Insurance Rating Bureau in Madison, Wisconsin, recently changed his home address to 409 West Wilson St., Madison, Wisconsin.

Suhr, Donald C., C.E., recently joined the force of the Herman Nelson Corp. in Detroit. He was formerly connected with D. W. Haering & Co. in Chicago.

1938

Rutter, Joseph Russell, E.E., is with the Illinois Bell Telephone Co., Chicago, Ill.

Sipp, Edmund Frederick, M.E., is with the Mills Novelty Co., Coin Operating Machines, 4110 W. Fullerton, Chicago, Ill.

Stehman, Harold Edmund, E.E., is in the Plant Engineering Dept., Montgomery Ward & Co., Mail Order House, Chicago, Ill.

Bodnar, Henry John, Ch.E., is a sales engineer with George S. Rogers, 228 N. La Salle, Chicago, Ill.

Kulik, Joseph Anton, Ch.E., is with the La Salle Steel Co., 150th and Magnolia, Hammond, Ind.

Dunbar, Claire Willard, F.P.E., advises that his engagement to Miss Rosemary Burgett of Nashville, Tennessee has been announced. The ceremonies are to take place in Nashville, early in January, 1940. Dunbar is an inspector with the Michigan Inspection Bureau in Detroit.

1939

The following is an almost complete record of the business connections of the class of 1939. Some names have been omitted because of lack of record and others because the men are not yet located. If this record is not correct please advise the Alumni Office. If there has been any change in your position or your mailing address please send this information in also.

Civil Engineers

Anthon, Harold, Western Factory Ins. Assoc.
Bugielski, Joseph Paul, Sears, Roebuck & Co.
Carlson, Ernest C., Page Engineering Co.
Collier, Thomas, Universal Atlas Cement Co.
Kirz, Benjamin, Bendix Products Division
Neubauer, Fred William, Illinois-Northern Utilities Co.
Reh, Carl W., Ramtite Co.
Saigh, Donald J., City Subway
Way, Donald M., Triangle Survey Co.

Electrical Engineers

Anderson, Gerald, LeCarbone Co., Inc.
Brewster, Franklin C., Victor J. Andrew
Bush, Reginald L., Whiting Corp.
Chevalley, Edward A., G. M. Laboratories, Inc.
Daniel, Emil J., Carnegie-Illinois Steel Co.
Felt, Winchester G., Industrial Products Co.
Gregory, Jack, Perry Graf Co.
Hebson, James D., Caterpillar Tractor Co.
Kotal, John Russell, Dryden Rubber Co.
Kurtz, William J., Commonwealth Edison Co.
Marik, Edward, Jefferson Electric Co.
McCormack, John Breckbill, Becker Bros. Carbon Co.
Osterberg, Edward K., Carnegie-Illinois Steel Co.
Quarnstrom, Thomas Francis, Carnegie-Illinois Steel Co.
Ropek, Leo Peter, Wm. Fecht & Co.
Strocchia, Lawrence, Chicago Surface Lines
Terp, Vernon, Quam Nichols Co.
Wooding, Lawrence F., Hub Electric Co.
Zarem, A. Mordecai, Fellowship, California Institute of Tech.

Mechanical Engineers

Barale, John, Industrial Mfg. & Eng'g. Co.
Bartlett, N. L., A. W. Richie Box Mfg. Co.
Bernstrom, Bernard, Carnegie - Illinois Steel Co.
Biddle, Milburn E., Central Screw Co.
Chapman, William Denison, Hibbard Spencer Bartlett & Co.
Clark, Thomas A., Jr., General Electric Co.
Davoust, Marshall A., American Molded Products Co.
DeLoor, Roger A., American Molded Products Co.
Dempsey, Arthur James, University of Michigan for Graduate Work
Derrig, George J., Buda Co.
Ephraim, Max, Jr., Electro-Motive Corp.
Footlik, Irving M., G. M. Laboratories, Inc.
Fridstein, Robert B., Tropic Aire
Gilbert, James, Jr., Public Service Co. of Northern Ill.
Giovan, Anthony C., Public Service Co. of Northern Ill.
Grabacki, Edward S., Atlantic Valve & Pump Co.
Graf, William, Jr., Danly Machines Specialties Co.
Griesbach, Bertram H., Carnegie-Illinois Steel Co.
Harrison, Herbert Lester, The Auto Part Co.
Henriksen, P. F., Kings Mills, Ohio
Jahnke, Fred George, Swift & Co.
Janicek, Joseph J., General Electric
Johannisson, Eric, Phoenix Metal Cap Co.
Koscinch, Edmund K., Powers Regulator Co.
Kroll, Stephen E., Johnson Suture Mfg. Corp.
Landow, Ernest William, Mall Tool Co.
Mileika, Paul Peter, Carnegie-Illinois Steel Co.
Miller, Samuel P., Alluvac Steam Control System
Mitchell, Edwin Charles, Autovent Fan and Blower Co.
Morris, Edward, Electro-Motive Corp.
Oswald, Bernard Francis, Industrial Gear Mfg. Co.
Rice, Norman D., Inland Steel Co.
Schlifke, I. Erwin, Bethlehem Steel Co.
Schwartz, Hyman, Crystal Tube Mfg. Co.
Soukup, Harry C., Giddings and Lewis Co.
Staron, Edward, Mall Tool Co.
Van Alsburg, Earl, Hydraulic Products Co.
Vanderkieft, Richard N., Chicago Subway
Volpe, Vincent F., Marblehead Lime Co.
Young, Richard W., Logansport Machine Co., Inc.

Engineering Science

Coyle, Howard R., Jr., Weil-McLain
Penn, William Henry, Republic Steel Co.
Wagner, Everett F., Servicised Products Co.
Williams, Robert M., Instructor at Parson's College, Fairfield, Iowa

Chemical Engineers

Bain, Lewis A., Jr., Industrial Sugars Corp.
Berger, Edward Charles, Phoenix Metal Cap Co.
Bjornstad, George, Wisconsin Steel
Boertitz, Roland B., Industrial Sugars Corp.
Buckman, William B., Jefferson Electric Co.
Calhoun, Thomas Borden, Phoenix Metal Cap Co.
Capodanno, William J., Hills McCanna
Fried, Arthur N., Servicised Products Co.
Grombacher, Julian, Carnegie-Illinois Steel Co.
Gryglas, Eugene D., Barrett Varnish Co.
Hofmann, William A., Jr., Asbestos, Asphalt & Insulating Mfg. Co.
Isakson, Eric Nils, Kimberly-Clark Corp.
Jaffee, Robert I., Agfa Ansco Film Co.
Johnson, Harold C., Bell & Howell Co.
Keane, John Daniel, Du Pont Co.
Kester, Milton C., International Harvester Co.
Kruse, Willard E., Standard Oil of Indiana
Levenberg, Allan, Chicago Extruded Metals Co.
Loutzenheiser, Edwin J., Jr., American Institute of Paper Chemistry
Lyckberg, Berndt K., Standard Oil Co. of Indiana
May, Richard Frederic, Carnegie-Illinois Steel Co.
McDaniel, Hardey Irving, Phoenix Metal Cap Co.
Moculeski, Sigmund J. L., Caterpillar Tractor Co.
Morris, Guy F., Caterpillar Tractor Co.
Pater, Anton Stanley, Industrial Sugars Corp.
Peltier, Paul J., Du Pont de Nemours & Co.
Peterson, Carroll Victor, Gulf Research & Development Co.
Ratto, John J., Socony Vacuum
Rothenberg, Harvey A., Seagram's
Ryan, William A., People's Gas Co.
Smith, Roger T., United Wall Paper Co.
Spengler, Allen John, America Fore Insurance Co.
Thodos, George, Standard Oil of Indiana
Thomas, George W., Phoenix Metal Cap Co.
Wittekindt, Roy H., Durkee Famous Foods

Architecture

Bradt, Robert A., Eugene Fuhrer
Cunningham, Thomas F., Pittsburgh Plate Glass Co.
Erickson, Edward H., Jack Rich, Inc.
Goldsmith, Myron, Accepted Scholarship
Husmann, George S., Atlas Iron Works
Michaels, Henry L., Jack Rich, Inc.
Moseley, T. Edwin, Garrick Construction Co.
Rea, John, Jr., Reliable Home Builders
Scott, George A., Cowles & Colean
Wagner, William A., Montgomery Ward & Co.
Wilkinson, John R., Pittsburgh Plate Glass Co.

Fire Protection Engineers

Anderson, Bolton G., Ohio Inspection Bureau, Columbus, Ohio
Dixon, Ralph E., Jr., Missouri Inspection Bureau
Finnegan, Stephen P., Fire Underwriters Inspection Bureau, Minneapolis
Gilbert, Allan W., Kentucky Actuarial Bureau, Louisville, Ky.
Hoffman, Paul M., Fire Insurance Rating Bureau, Milwaukee, Wis.
Jacobson, Daniel W., Illinois Inspection Bureau, Chicago
Morrison, Robert J., Hartford Fire Insurance Co., Chicago
Rogge, Donald C., Indiana Inspection Bureau, Indianapolis, Indiana
Swanson, Edward R., Ohio Inspection Bureau, Columbus, Ohio
Yeakle, Thomas W., Jr., Hartford Fire Ins. Co.

ARMOUR AND LEWIS UNITE

(From page 6)

graduate work in both day and evening classes.

For many years, Lewis Institute has maintained a successful course in home economics; this will be continued and developed further.

It is felt that emphasis on the humanities and the social sciences is necessary to attain the broad objective of the Institute, which is to develop in its graduates wider intellectual interests than have commonly been found in graduates in technology.

The agreement brings together the facilities and the staffs of two institutions which have long been engaged in research in the basic sciences and their engineering applications. It now becomes possible to combine these activities so that more important contributions to knowledge can be made. Research will be carried on by students and faculty in correlation with the educational program, and also through the continued activities of the Research Foundation of Armour Institute of Technology, which already has a record of three years of successful service to more than four hundred and fifty industrial organizations. It will be recalled that for many years pioneer work in cements and concrete was carried on at Lewis, and that it provided the basis for much of the design and technique involved in modern concrete structures and pavements.

Lewis Institute was established as the result of a bequest by Allen C. Lewis. Armour Institute of Technology was founded by Philip D. Armour. Mr. Lewis and Mr. Armour had the same motive; both wished to provide educational opportunities of a kind not then available to young men and women in this area. The merging of the two institutions brings together the resources provided by the two founders, and enables their basic objective to be achieved in a manner appropriate to existing conditions.

Many alumni and former students of Armour and Lewis have reached positions of leadership in science, industry, public service, and all phases of American life. Judged by their product, the two colleges have contributed continually to the cultural and economic development of Chicago and the nation.

Illinois Institute of Technology provides for the community greatly increased facilities for education and research, opportunities for the production of improved personnel for industry, and enhanced contributions to citizenship. It enables the young men and women of Chicago to find in their own community the best in technological education.

For every alumnus of Armour and Lewis, and for every graduate in the years to come, the union of the two colleges should bring increased pride and loyalty for his alma mater. In the community as a whole, the consolidation will unify support which has hitherto been divided between two institutions, and will permit those who wish to support education and research in technology to concentrate their efforts upon one major institution.

SHAKEDOWN CRUISE

(From page 16)

the need of a special filter. As it was most convenient to have at hand restaurants, hotels, stores and telephones, it was decided that the remainder of the day would be spent in Columbia City obtaining and installing the filter, making other improvements and getting some much needed sleep that night before taking the road again.

Rolling through even the sparsely settled farm regions, it was evident that thousands of people had driven considerable distances just to see the Snow Cruiser pass. Highways were lined with cars. Crowds gathered where no crowds had ever been before. Hundreds of school buses, some from rather distant schools, brought loads of children to line the road excitedly. Cameras appeared in unbelievable numbers, and merchants frequently reported a complete sell-out of photographic film.

Misfortune occurred at Gomer, Ohio. In rounding a curve at the end of a small bridge, the left hubs grazed the concrete bridge structure. Brakes were applied, and another of the troublesome hydraulic connections went out. The Cruiser left the road and plunged into a creek. An immediate survey showed the damage to consist of bent bearing-frames on two of the four wheel-motors. The first task was to make temporary repairs; the second was to get out of the creek. Repairs were quickly made, using the machine shop aboard the Cruiser. The more seriously bent of the motor frames was cut and re-welded into its proper position.

Getting out of the creek was another test of the Snow Cruiser's versatility. In a similar situation in the Antarctic it would have to come out under its own power, and it was designed with this fact in mind. Accordingly it should come out of this Ohio stream under its own power, and so it did. The Cruiser lay crosswise in the creek, its nose supported by the far bank. Cribbing—it would be ice and snow in the Antarctic—was placed under the hull. Sitting at the controls, Dr. Poulter caused the front wheels to lift themselves high, while cribbing was placed under them to give a firm foundation. The Cruiser then lowered its wheels and raised its hull. This process was repeated and soon the machine was resting on all its wheels. A bit of digging behind one wheel made the path smoother. Finally, using only about half of its available power, the Cruiser gently backed up onto the highway to resume its trip. After this demonstration the crew expressed confidence that their traveling laboratory could cope with anything that the Antarctic might offer.

There had been altogether too many failures in the hydraulic connectors. A telephone call to Newark brought a stronger type by airplane, and this trouble was corrected. Only one more "bug" was to show itself for removal before the end of the trip. Meanwhile the Cruiser continued on its way, receiving a tremendous ovation at Akron where it loaded two spare tires in its rear compartment and garaged itself for the night in the Goodyear Zeppelin hangar. A similar reception was met at Erie, where the damaged electric motors were replaced with new ones. Thereafter faster travel was permissible, for the speed had been kept under twelve miles per hour to avoid trouble with the temporarily repaired units.

At Pavilion, New York, the Cruiser stopped by request to allow children from the nearby State School for the Blind to see it with their fingers. This stop was prolonged for the rest of the day when it was found that an oil filler-pipe had broken off, causing damage to a gear-bearing in one wheel mechanism. Rather than replace the bearing at the time, the motor was disconnected from this wheel, the other motors being enough even for the long steep grades in the mountains that lay ahead. Final repairs and redesign of the oil line was left for the long sea journey to follow.

The Pavilion incident marked the end of the "shaking-down." The remaining 427 miles to Boston developed no new troubles, despite long ten-percent grades uphill and down. The demand for ceremonial stops continued to increase, as did the crowds. As many as five radio broadcasts were made by the members of the party in a single day, usually from within the Cruiser. Mobile broadcasting units joined the cavalcade and relayed descriptions of the progress to their stations by short wave. Brief stops were made at Schenectady and Troy. At Springfield, Mass., the Cruiser was driven to the Shriners' Hospital for the benefit of the shut-in children.

News flashes kept the excited citizens ahead posted. Appearance of the advance police never failed to increase the crowd. Once the crew saw the congregation of a church pour into the street, to file back in after the Cruiser had passed. At night and in the early morning people appeared on

their lawns in pajamas, and flashbulbs flared. At Framingham, only twenty miles from the goal, throngs grew so large that it was impossible to continue through them. Traffic officials estimated 72,000 automobiles, not to mention the multitude on the sidewalks. The party spent the night within the protective confines of the Framingham State Police Barracks, awaiting the early hours of the morning for the finish of the trip.

As the convoy rolled onto the pier at the Boston Army Base the Snow Cruiser's horn was answered by welcoming blasts of the whistle on the North Star. The two crews mingled, shook hands and slapped each other on the back. Thus ended a nineteen-day journey of 1,021 miles, in the course of which a radically new vehicle had evolved from an experiment to a successfully operating machine and had shown its power to meet the worst of situations without aid.

Loading of the Cruiser aboard the North Star proceeded at once according to schedule. While the deck of the ship was made ready, the spare tires and other cargo were lifted out of the rear compartment and stowed. Acetylene torches cut off the tail of the Cruiser along a line provided for in its design to avoid dangerous overhang in rough seas. When the tide brought the ship's deck level with the pier, a tugboard pressed the North Star tightly against the piling while Dr. Poulter drove the Cruiser aboard. The machine lowered itself onto its belly and was made fast with chains, and the tail section was placed on deck by the ship's tackle.

The story of the Snow Cruiser has only begun. As this is written the ship has passed through the Panama Canal and is on its way to the Antarctic, where the real adventure will be recorded. Meanwhile the public has seen what goes on in a shakedown cruise, generally conducted with secrecy on a private proving ground.

The Research Foundation is anxious to add to its photographic record of the Snow Cruiser, both in movies and still pictures. It will be deeply grateful to alumni and friends who care to contribute or lend prints or negatives. Movie shots, especially 16 mm., are desired and will be returned immediately after duplicates have been made. Such material should be addressed to the author at the Research Foundation of Armour Institute of Technology, 35 W. 33rd St., Chicago. Don't forget your return address.

PROGRESS IN MUSIC

(From page 20)

colors, and flexibility. It is an orchestra in itself and can express almost any musical thought in response to a skilled touch. The beauty of organ tones arises from the combination at will of many ranks of pipes, each possessed of a large and varied number of harmonics. The harmonic content of the tones is dependent upon the shape of the pipe and the air pressure. As might be expected, the variety of really different tones that pipes and reeds can produce is quite limited so pipe organs are based on a few basic tones and in some cases there is only a slight difference between the tone made by a pipe in one rank and a pipe in a rank having a different name. When two or more ranks of pipes are played at the same time the complex tones produced by one rank add to the others, forming a combination having a still different character. Thus, the characteristic tone colors of the organ are produced by ranks of pipes variously voiced and of different pitch, brought together to form an ensemble in which each of the parts performs a distinct auditory function. Another factor contributing to the richness of the organ is the choir effect. This effect is obtained whenever several pipes, instruments, or voices sound in unison. A section of first violins in a symphony could not be replaced by one violin and an amplifier to give equal volume, for the chorus effect would be lost. Several violins sounding in unison are not exactly in tune with each other and there exists a constant variation in pitch and phase relations between the instruments that produces the rich warm depth of a chorus.

Among the disadvantages of the pipe organ are its bulk, weight, initial cost, inefficiency, sluggish response to keying, change of tuning with temperature and humidity changes, and cost of upkeep. The space required for an average three-manual organ is about 6000 cubic feet. The weight of organ ranges up to thirty tons and the cost from $750 to $25,000 or more.

Since the organ is such a useful instrument it is natural that much attention should be turned toward making electronic substitutes for the pipes in order to eliminate many of the disadvantages and yet retain the advantages and create many new possibilities. The two organ-like instruments of electronic operation that have made notable success commercially to date are the Everett Orgatron shown in Figure 4 and the Hammond organ.

The Everett instrument, illustrated in Fig. 4, employs reeds for tone generators. Its performance is equivalent to a small pipe organ except that it has a better power range and somewhat better flexibility.

The Hammond organ synthesizes tonal qualities by adding the output waves of ninety-one tiny electromagnetic generators. The synthesizing of tones may be controlled by the musician through the use of harmonic controls. These controls provide amplitude regulation for a series including all harmonics up to the eighth, excepting the seventh, which is omitted for constructural reasons; in addition to these, subfundamental and subthird harmonic controls are provided making it possible to mix nine components together in any desired amplitude ratios. Probably one of the chief criticisms made of this instrument is in regard to the abruptness with which tones are initiated and released, producing rather square envelopes as in Fig. 1-D. This is particularly noticeable, since pipe organs and other classical instruments do not produce waves with envelopes of this shape. Some reactionary prejudice was aroused because this instrument used tone synthesis instead of predetermined tone qualities. The argument was used that scientists can analyze a tomato but cannot synthesize one, but this example does not apply to tone synthesis, for scientists can synthesize practically any musical tone.

Pianos have been electrified in varying degrees under license of the Miessner Inventions, Inc. The tones are generated in these instruments by vibrating strings struck by hammers in the conventional manner. The electric pick-up may be electro-static in a manner similar to the reed generator in Fig. 3, or by one of several other methods. The Ansley Dynatone in Fig. 5 is an electric piano with a phonograph and radio combined.

Changes in musical instruments, like changes in other things, cannot be made too fast because of unfavorable reactions. When the Hammond Instrument Company announced that their Novachord, a new instrument containing about 146 radio tubes but no moving tone generators, could produce the tones of the Hawaiian guitar, French horn and several other instruments it was scorned by the musicians' union because it was felt it might be a detriment to the musicians. Progress is now being made in music, however, and it will continue as fast as the people will accept it.

VALVES

(From page 22)

valves should possess in themselves, among which may be mentioned ease of operation, durability, safety, tightness, and utility. While each of these items of quality is affected by many details in the construction of a valve, it is also true that in many cases one single item may influence several qualities.

Some of the important factors of satisfactory valve service depend upon the following: (1) handwheel design; (2) yoke-sleeve metal; (3) proper threads between yoke sleeve and stem; (4) rigid yoke to keep stem in proper alignment; (5) packing-gland construction to avoid binding; (6) the right kind of packing in stuffing box; (7) tight bonnet joint; (8) disc and stem connection; (9) durable seating metals; (10) true and tight body rings; (11) correct thread lubricants; (12) conformance to accepted standards. Obviously, there are other factors of valve construction and materials that affect the life and service of valves, but those mentioned are among the most important.

Pressure and Temperature

Generally speaking, there have been no radical changes in the design of standard brass and iron valves during the past thirty years; valves still have their hand-wheels attached to a stem which passes through the yoke and stuffing box to the seat and disc construction. But it must be remembered that thirty years ago, the maximum pressures encountered in commercial service seldom exceeded 150 to 200 pounds on saturated steam lines, super-heated steam being a rarity.

But in cast and forged steel valves, many new features of design have become necessary to meet the exacting service of high temperatures and high pressures, among which may be mentioned ball-bearings at yoke sleeves, lubrication devices on stem threads in large valves, non-galling bushings at places where stems pass through bonnets and stuffing box, extra-long fitted guides on gate-valve discs, better bonnet joints, and, of course, a variety of new metals and alloys. Today there are a number of piping installations at 1500 pounds and temperatures as high as 950 to 1000 deg. F. They go even higher in the oil industry.

As a startling contrast to these extremely high temperatures to which valves are subjected, in certain kinds of processing industries valves encounter sub-zero temperatures as low as—150 deg. F.

Engineers, of course, appreciate the significance of these extremes in service temperatures in piping installations but even a layman must be impressed with the remarkable development of valve design and construction to enable the proper harnessing and control of matter within this extreme range of temperature.

The Result of Research

The present degree of dependable service of piping materials has been brought about through long and intensive research in the realm of metallurgy, welding, radiography, photography, physics, and chemistry, as well as in laboratory control. Crane Company was the first concern in the valve and fitting industry to visualize the fact that service requirements were becoming increasingly severe, and, as such services grew apace, it established departmental laboratories for the improvement and control of metals used in the manufacture of piping, valves and fittings.

As a result of all this research in the field of industrial piping, the valve family tree has spread its branches far and wide. Plant operators today do not expect one kind of valve to serve wherever a valve is needed. They know that there is no such cure-all. Instead, a careful study is made of the kinds of service required and then selection is made of valves best adapted to each particular service. From what has been said, it should be clear that this involves many components, including pressure, temperature, velocity, size, physical characteristics, location, maintenance, and others, almost ad infinitum.

In all this activity the handwheels of countless valves have spun left and right, opening and closing the traffic through arteries of commerce which stagger the imagination. Therefore, while our modern "open sesame" brings necessities, comforts and conveniences to mankind, it should be remembered, too, that the closing of a valve is just as important to the valve itself to assure its longer life and still greater opportunity to serve.

CHICAGO SUPERHIGHWAYS

(From page 27)

where density of traffic flow dictates, and should be built so as to avoid damage, and as far as may be feasible, to constitute an improvement, aside from its traffic value, to the streets, the properties, and the localities through which it runs as well as to the city as a whole.

Its basic specifications should include the following:

(a) Continuous grade separation for all cross traffic, both vehicular and pedestrian;

(b) Separation of the through traffic lanes from abutting property;

(c) A limited number of poitns of access to the through traffic lanes;

(d) Longitudinal separation of the roadways;

(e) Traffic lanes of ample width, well defined; and

(f) Adequate terminal facilities.

In line with basic specifications for superhighway construction, Mr. Harrington and his collaborators developed the comprehensive system of superhighways, providing for the following:

Continuous grade separation of express roadways from streams of cross traffic, vehicular and pedestrian; separation of through traffic lanes from abutting property; limited points of access to the through traffic lanes;

Separated roadways, traffic lanes of ample widths, and adequate terminal facilities;

Eight-lane roadways; four lanes, each twelve feet wide, in each direction, are also proposed.

Depressed highways wherever possible to be flanked by wide rights-of-way, varying from 200 to 400 feet in width, which are to be suitably landscaped.

Enhanced safety through the elimination of all pedestrian traffic interference, of parking, of the intermingling of fast and local traffic, and of turning movements.

The engineers have divided the program into two sections, one for immediate construction, the other for future construction.

The initial system embraces the following:

Route	Limits	Length in Miles	Estimated Cost
North	Foster to Bryn Mawr	0.7	$ 3,000,000
Northwest	Orleans to Menard	9.3	30,000,000
West	Outer Drive to Austin	7.7	32,000,000
Southwest	Harrison to Garfield	7.3	29,000,000
Southeast	49th to State Line	7.5	16,000,000
	Total	32.5	$110,000,000

The routes of the initial system, subject, of course, to changes that may be adopted by the City Council as a result of the public hearings now being arranged, are as follows:

North Superhighway — Extension of the North Outer Drive from Foster Avenue to Bryn Mawr Avenue to relieve congestion in Sheridan Road north of Foster Avenue.

Northwest Superhighway — From the northwest corner of the loop in a reasonably direct line to a connection with the Northwest State Highway near Menard Avenue. This route will relieve traffic congestion on a number of important streets, notably Lake Shore Drive and the West Side boulevards.

West Superhighway—From Columbus Drive to Grant Park along Congress Street and Van Buren Street to Columbus Park, there connecting with Jackson Boulevard and new roadways that are to be built around the south side of the park. The thoroughfare will be 120 feet wide in the distributor zone, from Michigan Avenue to Wells Street, and embrace two forty-two foot traffic lanes separated by an eight-foot center parkway, and flanked by fourteen-foot sidewalks.

There will be a terminal plaza from Wells Street to the Chicago River between Lomax Place and Congress Street to provide for efficient distribution of the superhighway's traffic just east of the river.

The plans provide for elevating the highway from Canal Street to Throop Street, and depressing it from Throop Street west to Columbus Park in a right of way varying from 235 to 400 feet in width.

South Superhighway — From the southwest corner of the loop in Wells Street and Franklin Street (extended) to Cermak Road, then along the general line of Archer Avenue to the vicinity of Thirty-first Street and Damen Avenue, and finally south between Ashland Avenue and Western Avenue to Garfield Boulevard.

Southeast Superhighway — From Forty-ninth Street and the South Outer Drive south and east to connect with Indianapolis Avenue at or near the Indiana State Line.

The future program follows:

Route	Limits	Length in Miles	Estimated Cost
North	Bryn Mawr to City Limits	2.5	$14,000,000
Northwest	Menard to City Limits	3.3	11,000,000
West (Second)	Outer Drive to City Limits	8.2	32,000,000
Southwest I & M Canal	Damen to Harlem	7.3	7,000,000
South Extension	Garfield to 74th	2.7	10,000,000
North and South—Crosstown	31st to Northwest Superhighway	5.7	21,000,000
	Total	29.7	$95,000,000

For the future program the general alignment of routes is as follows:

North Superhighway—From Bryn Mawr to the City Limits, completing the North Superhighway within the city.

Northwest Superhighway — From the Menard Avenue terminus of the initial Northwest Superhighway to the City Limits.

West Superhighway — (Second) — From the Outer Drive west along the approximate line of the Galena Division of the Chicago and North Western railroad to the City Limits.

Southwest Superhighway—An extension from Damen Avenue Southwest over the Illinois and Michigan Canal, which is to be filled, to Harlem Avenue, also an extension of the initial Southwest Superhighway from Garfield Boulevard south to connect with the Southwest Highway, that now ends at Seventy-fourth Street and Western Avenue.

North and South Crosstown Superhighway—From a connection with the proposed northwest superhighway between Ashland and Western Avenues south to a connection with the Southwest Superhighway at 31st Street.

It will be noted that the initial system provides for a radial system of superhighways extending outward from the central business district.

This choice was made because a study of the traffic movement on the city's existing highway system shows conclusively that the most intense movements are those that flow to the central business district from all parts of the city, the suburban area and the metropolitan region.

There are also movements of high density north and south with particularly high concentrations in such thoroughfares as Ashland Avenue and Western Avenue. Therefore, it is proposed to articulate this initial radial system by the north and south superhighway reaching across the city in the area between Ashland Avenue and Western Avenue.

When the system with its north and south cross-town connection is completed, there will be a convenient means for long distance traffic with destinations on the West Side to avoid the central business district.

Estimates based on detailed traffic-flow studies indicate that the five superhighways recommended for initial construction will have a combined capacity for the movement of 30,000 vehicles in one direction per hour. The use of these highways, it is estimated, will reach an average total of 250,000 vehicles daily passing the points of maximum flow and a total initial travel aggregating 600,000,000 vehicle-miles annually.

The superhighways will connect at or near the city limits with the more important trunk highways. Existing distributor streets will be connected to the superhighway system by grade-separated ramps at various intermediate and downtown focal points.

The ramps and connecting roadways are planned with ample capacity to provide capacity for any traffic situation which may reasonably be expected to develop in the future. The ramps will care for two lanes of traffic and are designed to secure a smooth flow of traffic in and out of intersecting and distributor streets. Ramp connections will also be designed to provide ample storage capacity so that there will be no backing up of traffic.

There will be traffic control signals and adequate easy accelerating and decelerating lanes for vehicles entering or leaving the express roadways. Pavement surface on the ramps will be radically different in color from that used on the express roadways.

High visibility will be provided by the latest type of lighting. Exhaustive studies of day and night accidents have proved the necessity for proper lighting to make effective the safety features that are built into modern highways.

It is also planned to construct curbs with reflecting surfaces normal to the headlight rays and drivers' vision. The reflecting surfaces may be designed with such spacing as to present to a driver's view a continuous band of reflected light.

As an argument against depressed highways, the question of snow removal and drainage is sometimes raised. The plans provide for berms at both sides of the roadways to provide for temporary storage of snow. Drainage is to be cared for by the construction of a complete new system connected to sumps from which storm water will be pumped to the existing sewer system.

Widespread benefits will result from the construction of this superhighway system.

Local and through traffic will be segregated throughout the urban area, thus accelerating the flow of through traffic, and the movement of local traffic on distributor and feeder streets.

Traffic congestion will be eliminated throughout the urban area, and in many cases along thoroughfares and at street intersections somewhat distant from the superhighways themselves.

An analysis of traffic accident records in Chicago indicates that more than 2,700 traffic injuries and 80 deaths can be expected to be eliminated each year after completion of the initial system. It is estimated that motorists will save $16,000,000 annually in time and operating costs.

There has been a general impression that suburban residents will obtain the greatest benefit from a superhighway system. This is a fallacy. Comprehensive studies show that the majority of use and benefit will flow to motorists whose trips originate within the limits of the City of Chicago.

The financial program advocated by Mayor Kelly, and enacted into law at the last session of the Illinois General Assembly, authorizes the City of Chicago and the County of Cook each to pledge for the next twenty years a part of its share of the state motor-fuel tax (but not to exceed fifty per cent) for superhighway construction.

Preliminary plans have been based on the assumption that each of these two political subdivisions will contribute at least $30,000,000 toward the proposed initial program of $110,000,000. This can be done without detriment to the improvement of other streets in the city and the county, since there will be adequate motor-fuel tax revenue remaining for this purpose.

Officials of the state highway department have indicated on several occasions that the state will participate in the program on a pay-as-you-go basis, since the state has admitted the need for constructing adequate terminal facilities in the Chicago metropolitan region for its primary road system.

If it is assumed that the state will participate to the same extent as the city and the county, there will be a total of $90,000,000 toward the cost of the initial program.

There is, in addition a strong possibility of Federal Aid. Mr. MacDonald's constructive recommendations for a national highway program, including the acquisition of all right-of-way in large metropolitan areas, are before Congress and probably will be considered at the forthcoming session.

Under Mr. MacDonald's plan, the Government would pay the entire cost in the first instance of acquiring these expensive rights-of-way and permit municipalities, such as Chicago, to construct highways upon them and eventually to acquire title by repaying the Federal Government over a long term of years at a low interest rate.

ARMOUR RELAYS

(From page 32)

Cunningham, whose all-around record for the mile has not yet been surpassed.

We might take much space in mentioning the powess of the athletes who come to the Games each year to compete in the shot put, the pole vault, and the high jump, but we must not neglect the equally exciting events—hurdles, dashes, and relays. And we must do justice to a man who came from Kansas to show Chicagoans how to toss a weight. Truly a dark horse, in race-track parlance, Elmer Hackney last year, in the shot put, broke a four-year-old record and established a new one of fifty-one feet, nine and one-fourth inches.

In the running events, we have repeatedly seen notable performances by men from small colleges. Little Ed Wagner from North Central turned the crowd into a roaring mob with his record-breaking run in the quarter-mile, and then repeated by anchoring his team to victory in the sprint medley relay. Similarly, Walter Shelton of Marquette nosed out Walter Kauffman of Wisconsin to take first place in the dash and to equal the record for this event established by Johnson of Illinois State Normal in 1933.

Other names come to mind: Rikli of North Central; Eizak of Wayne; McCormack of Notre Dame; Broeksmith and Lash of Indiana; Black of Chicago; Burns of Butler; Sandback of Purdue; Finch of Northwestern; Quinn of Michigan Normal; Burke of Marquette; Beckel of Northern Illinois State Teachers; Neal, Finnegan, and Bingham of Armour; and a host of others.

In 1939 four records were broken, and one was tied. In 1938 four records were broken. Each year new aspirants come to run the gauntlet of public opinion. Each year the Relay Games proceed toward their goal of being the crowning event of the indoor season in the middle west, and one of the most important in the United States.

The tentative date for the 1940 Games is March sixteenth. The place is the Field House of the University of Chicago, on what has been called the best indoor track in the world.

HELP! HELP! HELP!

(From page 35)

The engineer who will eventually fill this position is undoubtedly employed at the present time.

There are not sufficient records in our files of engineers whose experience qualifies them for positions with a salary range of from $5,000 to $75,000. At present the Department has an opening for a supervisor of a testing laboratory. The salary for this position is between $5,000 and $6,000, depending upon the past experience of the engineer who will be employed.

As the year draws to a close, the Department is pleased to announce that ninety-seven and one-half percent of the Class of 1939 have been placed. In a few instances the graduates of this class have been shifted out of one position into another. The majority, however, are apparently very satisfactorily placed.

The number of day students who have indicated a desire for part-time employment prompts this request: if you know of any opening for these lads, please communicate with me. These students have had varied experience and are willing to undertake almost anything. The work does not necessarily have to be of a technical nature.

Do not postpone sending in your request for a Placement Record. It will be mailed to you at once.

John J. Schommer,
Director of Placement.

BLIND CHILDREN SEE CRUISER

No one has estimated how many people saw the Snow Cruiser on its journey from Chicago to Boston, which is described in an article in this issue. The crew, and the accompanying personnel, were pleased at the interest shown, although the enthusiasm of the spectators made it rather difficult to carry on the regular routine.

From the aspect of human interest, perhaps one of the most affecting episodes of the trip was at Batavia, New York, where the giant vehicle was examined by pupils from the New York State School for the Blind. Our files containing letters from the superintendent of the school and from many of the boys and girls are interesting reading. We quote briefly:

Enclosed please find several letters written by our students concerning your courtesy in stopping the Snow Cruiser in order to allow the students at the New York School for the Blind to examine it with their fingers. These letters are written both in ink print (typewritten) and in braille.

It was of great interest to me to be able to see the Snow Cruiser as it passed through Western New York. I had heard a great deal about it and was very anxious to see it. I feel now that I have a very good idea of the size and structure of the Cruiser. The last time that Admiral Byrd went on his trip to the South Pole I was very much interested in his experiences. I tried as much as I possibly could to keep up with his experiences either by hearing teachers reading about them in the newspapers, or by listening to the news broadcasts over the radio. I know that because I have been able to see the Snow Cruiser this trip will be of even greater interest to me than the last one was.

I was impressed by the size of the machine and that so large an object could move. When I first felt the wheels I could not believe that so large a wheel was possible.

As I do not see, I could not give you my impression of the lighting or the color scheme. Through pamphlets I have learned of the inside, which amazes me. Even though it was raining, it was the thrill of my life. I wouldn't have missed it for anything.

We students of the New York School for the Blind wish to express our appreciation of the opportunity afforded us to examine the Antarctic Snow Cruiser. We realize that stopping the Cruiser for our benefit was made possible through your generosity and the cooperation of the crew and the New York State Police.

The part of the vehicle which impressed us most was the huge size of the wheels and tires. The location of the motors and the outside structure were also unusual. We wondered if the red color was for the purose of quick discovery from the air in the Antarctic. The Snow Cruiser is important historically as well as scientifically, and we were fortunate to have an opportunity of seeing it.

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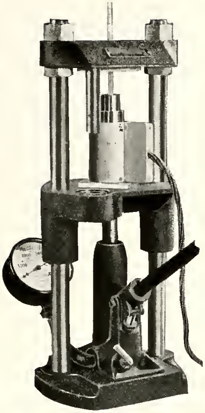

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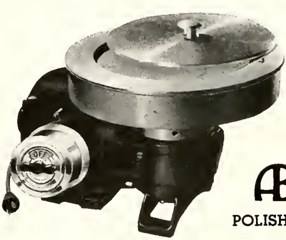

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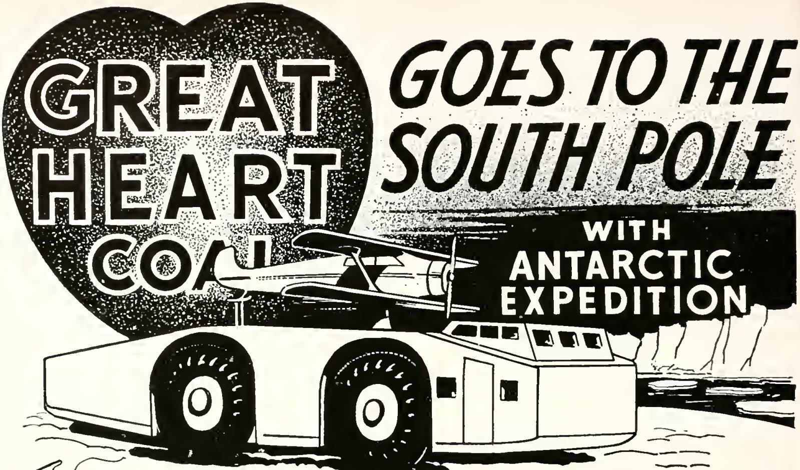

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In selecting coal for heating and cooking at the base camps of the new Byrd Antarctic Expedition, the scientists in charge sought uncommon qualities.

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The extreme necessity of eliminating useless weight, called for coal with the least possible moisture and ash.

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These requisites could be obtained in no ordinary coal. They stood for quality of the very highest order. It is therefore a clear tribute to the outstanding worth of GREAT HEART that it was approved and selected for the use of the expedition.

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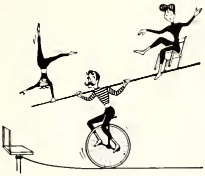
ARMOUR ENGINEER

AND ALUMNUS

March, 1940

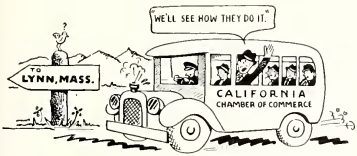
G-E Campus News



SIMPLIFIED BALANCING

HOW about balancing a 50-ton generator rotor turning at 3600 rpm? No, not on the end of your chin or anything like that, but balancing it until its vibration is less than three ten-thousandths of an inch—or one-tenth the diameter of a human hair! Not so easy, you say? Well, a little while ago you would have been right, for the balancing of a large rotating machine was a long-drawn-out procedure, perhaps requiring the removal of the rotor from the machine.

But today there is a G-E portable instrument that does the job simply, quickly, and under actual operating conditions. A 20,000-kva synchronous condenser, for example, can sometimes be balanced in as few as three runs—a far cry from the 100 to 170 trials which were frequently necessary before.



WEATHER MAKERS

CALIFORNIA'S weather has always been a source of pride to the natives, but, when it comes to actually making the weather conditions you want, the G-E engineers at the West Lynn Works are in a class by themselves.

These engineers produce temperatures ranging from 40 below zero F to 160 above and a humidity of 100 per cent if so desired. But they really aren't trying to compete with California. The excuse for all this weather-making is the testing of watthour meters. For G-E engineers want to be sure the meters are capable of accurately recording the amount of electric energy consumed under varying conditions of temperature and humidity.

To insure this, the meters are tested at temperatures more extreme than they would ever normally encounter and in atmospheres saturated with moisture. Such tests, made by young college-trained engineers, assure reliability.

THIRD GENERATION

GENERAL Electric became a proud grandfather this year, when Charles E. Wilson became president and Philip D. Reed chairman of the board of directors—the third generation of G-E leaders. They will carry on as "captain" and "navigator" of General Electric in place of Gerard Swope and Owen D. Young, who held these positions from 1922 until their retirement at the first of this year.

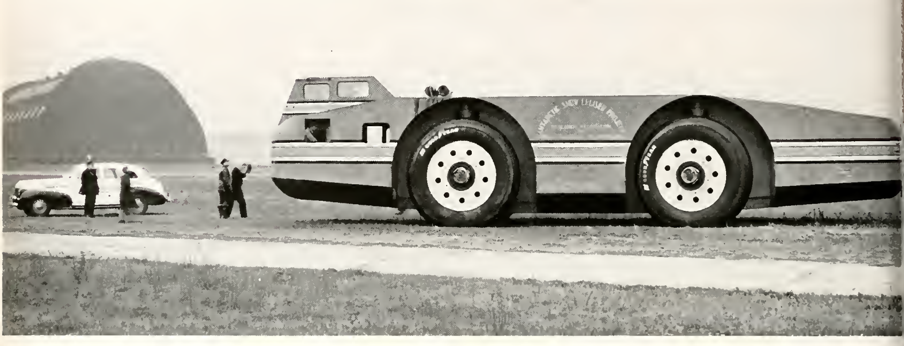
Mr. Young and Mr. Swope leave behind them a brilliant record of achievement. Under their leadership General Electric fostered a great new branch of the electrical industry—the manufacture of appliances which eliminate the drudgery of housework and create comforts and conveniences for the home.

Through their efforts General Electric's many employee plans were achieved—old-age pensions and group life insurance, a wage-adjustment plan to meet increases in the cost of living, vacations with pay, an employee savings plan and many others—ample evidence that these executives were many years ahead of their time in vision and consideration for the welfare of their employees.

GENERAL ELECTRIC

90-239C

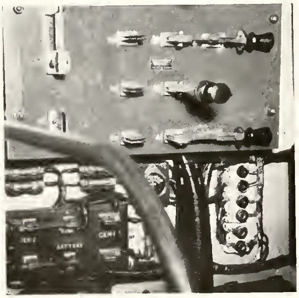
THE SNOW CRUISER
BOUND FOR THE SOUTH POLE



The Cruiser does not need a garage, but it rested overnight in the Goodyear-Zeppelin hangar in Akron on the occasion of the recent "Shakedown Cruise" from Chicago to Boston.

ELECTRIC FUSES

FOR EVERY CIRCUIT



The main electrical instrument panel of the Cruiser with Tamres and Clearsite plug fuses in use (right), and Economy Renewable cartridge fuses (lower left).

Consider the plight of the men who on October 24th edged the 37½ ton Snow Cruiser into Chicago's swirling traffic and set out for Boston 1020 miles to the east, on the first leg of a 10,000 mile journey to the South Pole. No one had ever driven such a strange vehicle . . . no one had ever seen anything like it . . . there never had been anything like it! 55 feet long, 20 feet wide and approximately 12 feet high, this mammoth machine necessarily had to have protection for the electrical circuits upon which it depended for motive power, for light, for radio communication, for heat, for air conditioning, for scientific investigation, etc.

These electrical circuits are protected by ECONOMY RENEWABLE, ECO, CLEARSITE and TAMRES FUSES, the worth and dependability of which have been proven during 25 years of infinite care and development and constant usage.

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■ W. C. MENTZER is Chief Engineer of United Air Lines. He received his B. A. degree from the University of Nebraska and his B. S. degree from the Massachusetts Institute of Technology. After working for Boeing Air Transport and the Boeing Airplane Company, he entered the engineering department of United Air Lines in 1934. He was resident technical representative of this company for three years during the development, construction, and testing of the Douglas DC-4. Mr. Mentzer came to Chicago in 1938 to take up his present duties as Chief Engineer.

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■ ELDER OLSON is Assistant Professor of English. He is the author of Thing of Sorrow (Macmillan 1934) and The Cock of Heaven (to be published by Macmillan in Fall, 1940).

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■ S. M. SPEARS is Associate Professor of Civil Engineering at Armour Institute. He has done a great amount of research in highway planning during the past three years and has developed a course in City and Highway Planning. During this time Professor Spears has done graduate work in Traffic Engineering with Dr. Miller McClintock and Mr. Maxwell Halsey of the Yale Bureau of Street Traffic Research in addition to residence work in highway design, traffic control and highway transportation at the University of Michigan. He is at present interested in research on highway design and traffic control as affected by psychological factors. This research will be the basis of his doctoral dissertation at the University of Michigan.

■ CHARLES R. SWINEFORD, Associate Professor of Machine Design in the Department of Mechanical Engineering, received his degree of B. S. in Mechanical Engineering at the University of Michigan in 1904. He was designer of special woodworking machinery for the Saginaw Manufacturing Company, Saginaw, Michigan; and designed pumping machinery for Platt Iron Works, Dayton, Ohio. He has been instructor at the University of Michigan and was an engineer for three years with the Warm Springs Iron Works, Salt Lake City, Utah. He came to Armour in 1911. Mr. Swineford has had extended experience as consultant in the design of special machinery and industrial furnaces.

ARMOUR ENGINEER AND ALUMNUS

MARCH 1940
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Boeing 247-D Airplane Maintained Exclusively as a Flying Laboratory *United Air Lines. Photo by Gri*

ENGINEERING IN AIR TRANSPORTATION

By

W. C. MENTZER

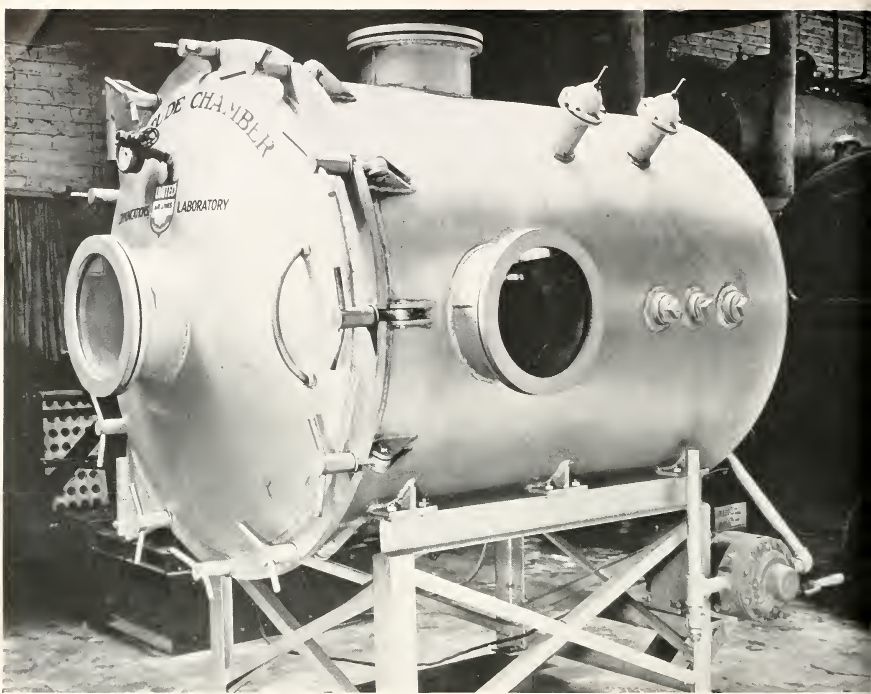
Less than forty years ago the Wright brothers made the first successful flight in a heavier-than-air machine. The development and usefulness of the airplane in the short span of time since the Wright brothers' first flight has been remarkable. In the specialized field of scheduled air transportation, development has been almost unbelievably rapid. Consider that in 1926, less than fourteen years ago, there was only one trans-

continental air service and this was government-operated and devoted exclusively to the carrying of mail; now the entire continent is served with a network of frequent, fast and comfortable air transportation, privately operated, and carrying not only mail but also passengers and express. The growth of this new medium of transportation has been incredible, breathtaking. What part has engineering played in this growth and development?

The airplane and its equipment require the utmost in design refinement because not only must each component be of the highest efficiency but this efficiency must be obtained with the least weight possible. Probably in no other field of engineering is weight such an important factor. In the design of the airplane structure great ingenuity is exercised to get the last bit of strength out of each component. The aircraft engine is not only one of the most efficient prime movers in general use but also is by far the lightest per brake-horsepower. The demands of high efficiency and light weight have necessitated the develop-

Interior of the Flying Laboratory

United Air Lines Photo



United Air Lines P

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ment of highly specialized engineering personnel and techniques in the aircraft industry.

As mentioned previously, scheduled air transportation has existed in this country for less than fourteen years. In the pioneering days the aircraft, engines and equipment were relatively simple compared to the complex units now operated and planned for the immediate future. In spite of its simplicity, much of the early flying equipment was far from being reliable and it became obvious that great improvements had to be made. It also became obvious that while the manufacturers of airplanes, engines and equipment were ready and anxious to improve all types of equipment, they frequently were not close enough to actual operation to appreciate all of the problems. Furthermore, many of the improvements developed serious weaknesses when put into service. Frequently these weaknesses could only be corrected by close observations of actual operation which, to be effective, required a complete understanding of the basic principles involved. Much equipment was needed which had to be developed almost entirely by the air line operator himself because his needs were so specialized. The natural result was the gradual building up of departments in the operating companies containing men trained in various phases of engineering.

At the present time the engineering problems of major air transportation companies fall into three general classifications, namely: (1) those concerned with airplanes, engines and airplane equipment; (2) those concerned with communications; and (3) those of a miscellaneous nature con-

cerned with airports, buildings, fuel facilities and the like. Consequently, air transport engineering functions and personnel are usually divided along these lines into separate specialized departments which, for purposes of identification, may be called the airplane engineering, communications engineering, and building engineering departments, respectively.

AIRPLANE ENGINEERING DEPARTMENT

One of the fundamental functions of this department is to keep the flying equipment operating safely and efficiently. It is, therefore, responsible for the supervision of ground mechanical personnel, and for the dissemination of servicing instructions to ground personnel and of operating instructions to flying personnel. This responsibility necessitates close cooperation with the manufacturers of all types of equipment and frequently requires the conduct of comprehensive tests on certain items of equipment to determine the best means of servicing or operating them.

For example, most modern airplanes are equipped with steam heat-

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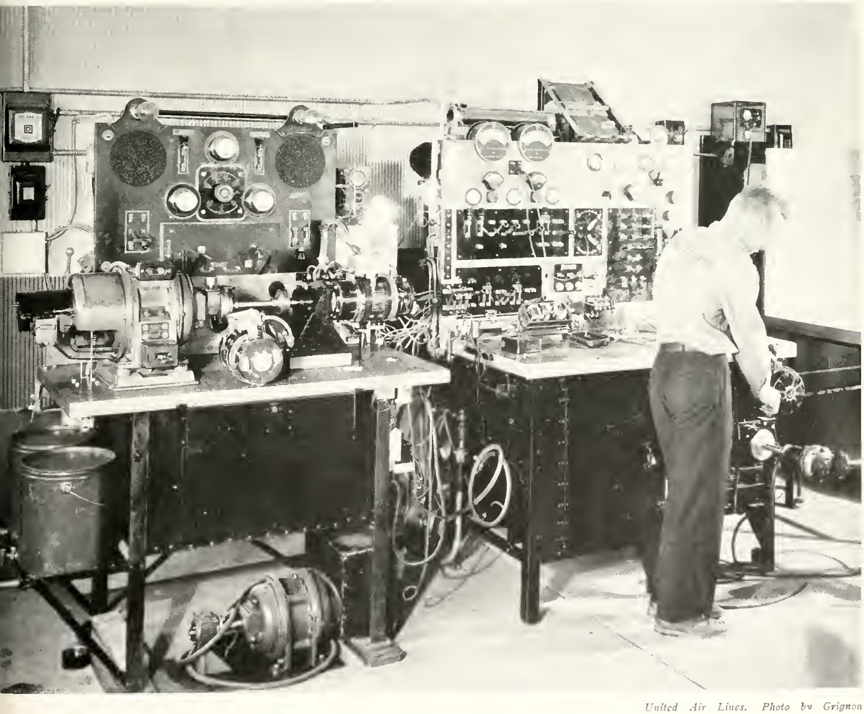


United Air Lines. Photo by Grignon

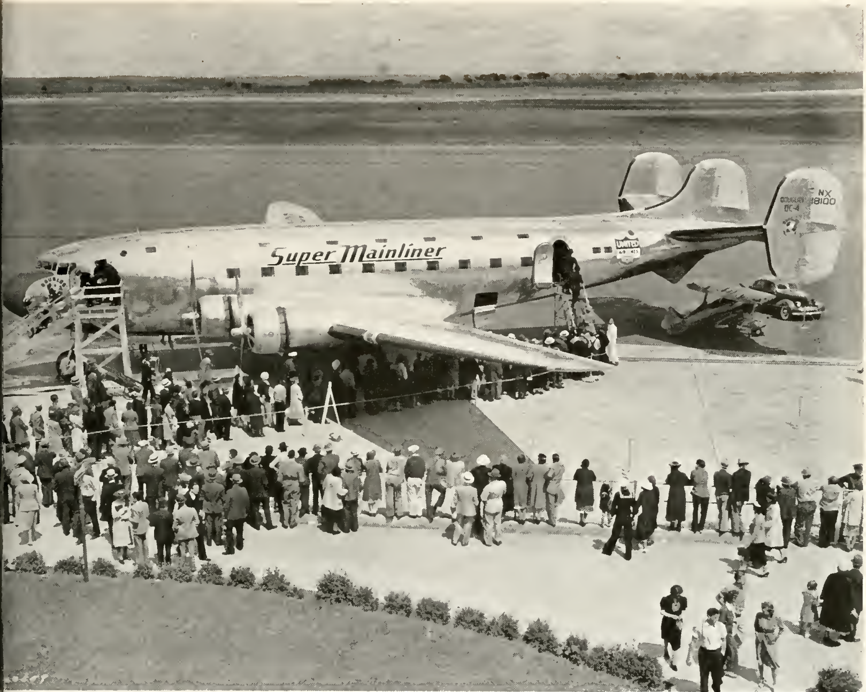
United Air Lines P

Boeing 40B-4 Early Passenger Carrying Airplane of 1927. Was Not Equipped with Radio and had Unsupercharged Engine and Fixed-Pitch Propeller. Carried Four Passengers and a Pilot

ing systems. When these systems were first placed in service much trouble was experienced with malfunctioning of various parts, freezing in cold weather, and improper operating technique. Careful analysis, testing, and redesign by the various groups of the airplane engineering department have overcome these difficulties and now reasonably satisfactory service is obtained, although much work remains to be done.

The steam heating system is also a good example of the condition mentioned previously where the equipment manufacturer cannot maintain close enough contact with his product under operating conditions to perfect it, and consequently this responsibility must be accepted by the operator's engineers. In fact, the perfection of all manner of equipment from spark plugs and heating systems to passenger seats and hot-food carriers is an important function of the airplane engineering department.

The periodic overhaul of airplanes and equipment brings to light innumerable shortcomings. Many parts wear out too rapidly or are not entirely suitable for their function. This condition can often be remedied by intelligent redesign. Frequently, redesign is impossible on existing airplanes but the transport engineer notes the shortcoming as a point to



United Air Lines Photo

Experimental Douglas DC-4, Developed to Joint Specifications of 5 Major Air Lines in 1939. Carries a Crew of Five and 42 Passengers. Thirty-Six Production Models Now Under Construction Will Have Pressurized Cabins

be corrected on new equipment when purchased.

In the original design of such a complex unit as an airplane it is impossible to foresee exactly what parts will require frequent service or overhaul. Frequently the accessibility of such parts is poor and the operator's engineering department must redesign to improve the condition. Improved accessibility of all parts is one of the greatest contributions of air lines engineers to the efficiency of modern transport airplanes.

All manner of special apparatus is developed for use in the overhaul and testing of airplanes, engines and accessories to ensure perfect operation after overhaul. Frequently, accessory equipment, particularly instrument equipment, is held to closer tolerances by the air transport repair bases than by the original manufacturers.

The aviation industry as a whole has grown to the point where competitive products are on the market in almost every instance. More and more, it is becoming the function of the airplane engineering department to analyze these products in detail to determine which is the most suitable and economical for the specific job to be done. Whenever possible, comparative laboratory and service tests are

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TRAFFIC CONTROL

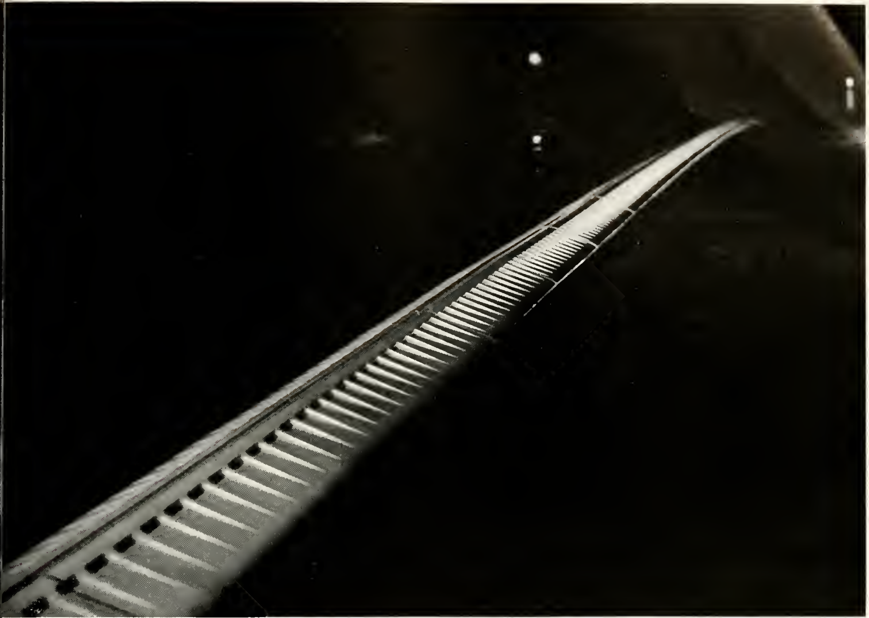
BY

S. M. SPEARS

It is doubtful if any field of the civil engineering profession so intimately concerns such a large portion of the population as does traffic control. Also this field is one about which a large number of the persons concerned have very definite opinions, which are almost invariably erroneous. Automobile drivers and pedestrians alike always believe they see the perfect solution for every traffic problem. This attitude is understandable in view of the fact that here is the one field of engineering about which the layman knows at least some things, since he is an integral part of the problem. This latter fact sets traffic control in a unique position among engineering fields, it being virtually the only portion of engineering where psychology plays an important

Traffic Circle at Intersection of New Jersey State Highway Routes Nos. 4 and 33, Freehold, New Jersey

Courtesy N. J. State Highway



Courtesy N. J. State Highway Dept.

This Photograph of the New Jersey State Highway Department's Reflecting Curb, Taken on a Rainy Night, and with Ordinary Auto Headlights Supplying All of the Illumination, Clearly Illustrates the Efficiency of This Type of Curbing as a Safety Factor. The Raised Fins of the Curb Reflect Headlight Rays Back into the Driver's Eyes, Clearly Outlining the Center Safety Island at Night. The Curbing Reaches Its Maximum Efficiency Under the Poorest of Driving Conditions

part. In every aspect of traffic control the engineers must keep constantly in mind human reactions to control conditions, else success cannot be realized.

Scope of Traffic Control

The scope of traffic control is much broader than one would suppose in casual thinking. In its broader aspects it embraces legislation, police power, taxation, licensing, vehicular movement, parking of vehicles, education and public safety. Effective traffic control is secured only through the cooperation of police, legislative bodies, educators, and engineers. This necessary cooperation has led to the adoption of the slogan, "The three E's of traffic engineering; Engineering, Education, and Enforcement." This article is concerned only with the purely engineering aspects of the three-facetted problem.

Chicago Park District P

Intersection Michigan Boulevard and Superior Street, Chicago

There have been traffic problems from the time when the first two men met on a prehistoric pathway, requiring one to yield the right of way, down to the present time, when the descendants of those same two men meet on the highways as the drivers of powerful wheeled projectiles. The complexity of the problems has increased greatly, forcing the evolution of modern methods of traffic control. The desire of man has always been to achieve the utmost speed of travel consistent with the degree of personal safety desired. The function of traffic control is to permit the maximum speed and ease of movement for all elements of traffic with safety to the entire population.

Early History of Traffic Control

Among the earliest recorded efforts at traffic control are those made during the reign of Julius Caesar, when central Rome, the hub of a 50,000-mile highway system, became congested. To relieve this congestion the central area of the great city was forbidden to vehicular traffic except for public officials and high ranking citizens.

Control in England

England had much legislation related to highway usage in the earlier years of the island as a populated area. During the reign of Henry the Eighth a court order was issued which declared, "The King's Highway is not to be used as a stable yard." This ruling was invoked in the punishment of a coach driver who allowed his vehicle to stand in the street between trips. Certainly this is the counterpart of today's parking regulation. The General Turnpike Acts passed in 1822 dealt extensively with the rules

of the road. Steam-propelled vehicles in 1836 received their first tax burden and the requirement that a flagman on foot precede the vehicle. This legislation was brought about by the efforts of stage coach drivers and horsemen. The modern equivalent of this is found in the constant enmity between our railroads and highway transportation by bus and truck. Omnibus drivers, by the London Metropolitan Streets Act of 1867, were forbidden to stand their vehicles in the streets for a longer time than necessary to load and unload passengers. Congestion in London led to the widening of street intersections into "circuses."

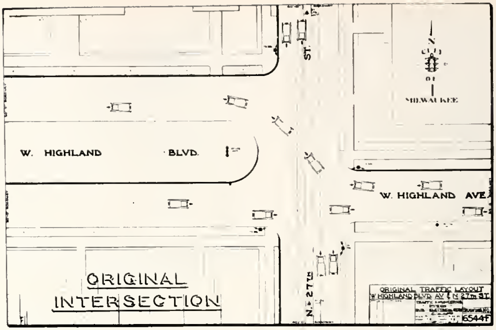
Early Traffic Control in the United States.

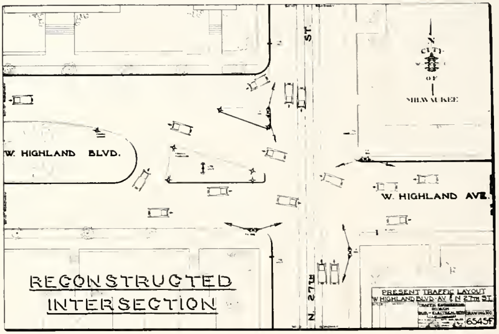
Rhode Island in 1678 enacted a law against reckless driving. In 1757 Boston, Massachusetts, had an ordinance limiting vehicular speed to a walking pace as a maximum. In the United States efforts at traffic control paralleled those of England with the exception that steam buses were not a problem in our country. The regulations dealt, in general, with speeds, standing time and rules of the road. No need was felt for further control until the advent of the automobile at the beginning of the twentieth century. Some idea of the rapidity of growth in the complexity of the traffic can be had by a comparison of vehicular registrations now and in 1895. In 1895 there were 4 automobiles in the United States and today we have 26,000,000 passenger cars and 4,000,000 commercial vehicles. Early traffic control was entirely by local units of authority with an attendant lack of uniformity over the country. Police officers at intersections could effect satisfactory movement of small volumes of the traffic but could not prevent congestion as more vehicles came onto the streets. The need for some automatic means of securing smooth coordinated flow was felt and this need led to the perfection of the modern signal system. Rural highways received no attention until demands for long-distance travel brought about the building of better thoroughfares, after which increased use required traffic control methods to be applied to rural as well as urban highways. Again we had no uniformity in handling of the problems.

The rising toll of deaths, injuries and economic losses due to improper handling of traffic problems led to the calling in 1924 of the First National Conference on Street and Highway Safety by Herbert Hoover, then Secretary of Commerce. This conference was sponsored by the United States Bureau of Public Roads (now the

Courtesy N. J. State Highway Dept.

Dual Highway, New Jersey State Highway Route No. 26, Near Penns Neck, New Jersey. This Route was Formerly an Undivided, Four-Lane Highway. It has been Converted into a Dual Roadway by a Unique Method known as "Slab Jacking." The Slab Immediately to the Left of the Center Island Was Moved Latterly a Distance of 12 Feet by Compressed Air. The Space Formerly Occupied by the Moved Slab has Become a Center Safety Island, Shaped, Seeded, and Bordered by Hand-Tooled Reflecting Curbing. An Additional Lane Was Added by Paving to the Left of the Moved Portion





A Milwaukee Street Intersection Before and After Reconstruction

Public Roads Administration of the Federal Works Agency), the American Association of Motor Vehicle Administrators, the American Automobile Association, the American Mutual Alliance, the American Transit Association, The Association of American Railroads, the Automobile Manufacturers Association, the Chamber of Commerce of the United States, the National Bureau of Casualty and Surety Underwriters and the National Safety Council. This conference and its successors accomplished a great deal toward establishing uniformity of traffic control throughout the country. The published handbook of the conferences, "Manual on Uniform Traffic Control Devices for Streets and Highways," is truly the traffic engineer's Bible. The Fourth Annual Conference in 1934 produced the following model legislative documents:

I. Uniform Motor Vehicle Administration, Registration, Certificates of Title and Auto Theft Act.

II. Uniform Motor Vehicle Operators' and Chauffeurs' License Act.

III. Uniform Motor Vehicle Civil Liability Act.

IV. Uniform Motor Vehicle Safety Responsibility Act.

V. Uniform Act Regulating Traffic on Highways.

Other organizations which have had an important part in developing modern traffic control methods are: the American Association of State Highway Officials, the American Standards Association, the American Society of Civil Engineers, the Highway Research Board of the National Research Council and the Institute of Traffic Engineers.

Modern Traffic Control

Intersections of routes are the most critical points in traffic control and much of the study of traffic problems has therefore been on intersections. It does not follow that every intersection requires the same kind of treatment nor does it follow that every intersection requires control devices of any kind. The guiding principle of the traffic engineer is to use as little in the way of control devices as possible and when an engineering study shows control devices to be necessary, to choose those methods which will accomplish the desired result with the least inconvenience to traffic. The normal progression of intersection control methods is: (1) a caution-type sign; (2) a slow-type sign; (3) a stop sign; (4) a traffic-control signal; (5) a rotary-traffic separator; and (6) a grade-separation structure.

Signs

Traffic-control signs may be classified in three broad functional groups: (A) regulatory, such as stop, speed, movement and parking; (B) warning, as slow, caution, railroad; and (C) guide, such as route marker, destination, location and information. In order to provide uniformity of significance and lead to easy observance by the average driver, standards have been established covering application, shape, color, location, dimensions, symbols, wording, lettering and illumination. It is surprising how few drivers realize that these standards are being used but nevertheless sound psychological principles indicate that greater effectiveness is possible without individual realization of the uniformity.

Uniformity of application follows from the usage of the definite principles of traffic engineering after traffic studies have been made. Standard sign shapes and colors are shown, for the various types of signs, in the following tabulation:

Photo Shows Appearance After Reconstruction of Milwaukee Intersection on Opposite Page. View Looking West

Type	Shape	Color Background	Color Message
Regulatory			
Stop	Octagon	Yellow	Black
Speed	Rectangle (Long dimension vertical)	White	Black
Movement	"	White	Black
Parking (Prohibition)	"	White	Red
Warning			
Slow	Diamond	Yellow	Black
Cantion	Square	Yellow	Black
R.R. Advance	Circle	Yellow	Black
R.R. Crossing	Cross Buck	White	Black
Guide			
Route Marker			
U. S.	Shield	White	Black
State	State outline	White	Black
Destination, Location, Inf'mation	Rectangle (Long dimension horizontal)	White	Black
Rest Station	Clover Leaf	Green	White

Yellow has been chosen for the field color on the most important signs after extensive research. It is the color to which the average human eye is most sensitive. Black for the message on a yellow ground gives the highest degree of contrast. Size of the sign and the lettering upon it has been and still is the subject of considerable research. The proper size of both sign and message is a function of the speed of the approaching reader and the degree of hazard indicating the sign requirement. Signs cannot always be placed effectively from a study of highway plan and profile maps. In a number of instances signs placed by map or even by personal surveys have not proved effective. Photographs for deliberate study in many of these cases have led to the proper solution. Emphasis cannot be placed too strongly upon the psychological aspects of traffic control. The visual characteristics of the average driver and his normal reaction to certain types of stimuli require the traffic engineer for the utmost success to apply psychological principles even though he may not recognize them as such.

Information signs with extensive messages are gradually yielding to types with a message not exceeding four or five words. At a passing glance the reading span of the average driver does not allow him to catch more than that number of words. Simplicity of all control devices is a cardinal principle.

Signals

A traffic signal is a device which by means of a changing appearance directs traffic to take some specific action.

Traffic signals have passed through an interesting period of development from hand operated semaphores, automatic semaphores and rotating lamp houses to the modern variable-color signal electrically connected into a system which permits continuous flow of traffic at a planned rate of speed.

Modern signals fall into two general classes: (A) traffic control, and (B) flashing. There are three types of flashing signals: (1) slow or caution; (2) stop; and (3) train approach. The traffic-control signals are of two general types, either fixed-time-of-cycle or traffic-actuated. Traffic-actuated signals receive their operating impulse from the weight of a vehicle passing over an electric treadle-switch or sensitive plate in the pavement. Their action is such that the cycle of stop and go fits itself automatically to the demands of the intersecting traffic streams. They can be either full-traffic-actuated or semi-traffic-actuated, the difference being that the semi-traffic-actuated has pavement-receptors only on one of the intersecting streets, the major thoroughfare showing green continuously until a vehicle on the minor street institutes a cycle of operation to allow its own passage. Other types of traffic-actuated signals have been invented but at present the electric pavement receptor is the only one in common use. The predecessors of this type used photoelectric cells and sound pickup devices. The latter proved to be somewhat of a nuisance since drivers were required to sound their horns to institute a cycle of operation. Fixed time signals which are used in the usual city systems are classified according to the type of timing as: (1) independent; (2) simultaneous; (3) alternate; and (4) progressive. The independent signal operates upon its own fixed time of cycle from a driving motor and is not connected in any way to other signals except through a common source of electric power. Synchronous motors may be used to cause the signals to form a system but continuous in-step operation cannot be maintained. In the simultaneous system all signals show the same color indication at any one instant of time, i.e. all red or all green. It is possible to arrange such a system for progressive movement of traffic but the possible speeds are in general not suitable for average city conditions. In general the simultaneous system leads to very frequent stopping of the stream of vehicles.

In the alternate system color indications alternate at the intersections along a single street either singly or in multiple, i.e. red, green, red, green or red, red, green, green, red, red. The alternate system cycle can be designed very readily to give smooth vehicular progression where block lengths are equal or practically so. Both the simultaneous and the alternate systems require a central master

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RESEARCH IN MATHEMATICS

By

RUFUS OLDENBURGER

It is a common misconception that mathematics is a finished subject, invented by a handful of superhuman Euclids centuries ago, and painstakingly passed down in unaltered form by dusty pedagogues to the present day. That mathematics has had a growth as rapid, if not more so, than the more material sciences of physics, chemistry, and biology is not generally known. It is perhaps safe to say that the growth of ideas in mathematics has proceeded more rapidly than in the other sciences because the researcher in mathematics is limited only by his background, native ability, and available time, whereas the researcher in the remaining sciences must usually test his ideas in a laboratory where he may be limited by the equipment at hand.

Behind many of the scientific and engineering achievements which men take for granted because they are so much a part of daily life there is a vast world of mathematical knowledge discovered by numerous investigators, a world which is in no sense complete, but which like all other fields of knowledge finds itself in the beginnings of its infancy. Thus such an apparently simple thing as directing a ship across the Atlantic makes use of some of the deepest phases of mathematics, as can be recognized by an examination of standard navigation tables. The angles made by lines from the observer to the horizon and from the observer to planets and stars at a given time of the year, as seen from Greenwich, England, are recorded in these tables. In order that a navigator may compute the position of his ship from readings with his

sextant and chronometer, it is necessary for him to make use of a transformation theory of mathematics whereby one is able to change the angle readings at Greenwich into angle readings at any point on the earth. This transformation theory involves such concepts as real numbers, coordinate systems, and trigonometric functions, the study of each of which runs into a forest of ideas. Naturally the ship's mate who computes the position of the vessel does not employ the mathematical transformations directly, but rather he uses tables to which he applies a series of operations in a mechanical fashion, often with but a vague conception of the theory on which it is founded.

The computation of position by means of tables and readings of the sextant and chronometer involves the use of logarithms based on infinite series, resting in turn on the concept of derivatives, and concerned with such questions as the convergence of sequences. The problem of transformation of coordinate systems arises again in planning the ship's course, for in making out a route the navigator uses a gnomonic chart obtained by projecting the earth's surface onto a plane so that great circles on the earth correspond to straight lines on this plane. By following a straight line on the map, the ship will travel along a great circle, which is clearly the shortest curve joining two points on the open sea. Although the projection of the earth onto the gnomonic plane brings "straight lines" on the earth into straight lines on the map, various geometrical properties are changed under this projection, such as the distance between points on the earth. The relation between corresponding distances on the sphere and on the gnomonic chart is a special case of the extensive theory of connections mathematicians have found between the "metrics" of various spaces.

Many inventions have been possible because applied mathematicians used the mathematics then available to predict the phenomena on which these inventions are based. Thus Clerk Maxwell was able by the theory of differential equations, already highly developed at his time, to prophesy the existence of radio waves, subsequently found in the laboratory by Heinrich Hertz and called after the latter's name. Later Marconi commercialized the discovery of Hertzian waves, and was acclaimed by the public as the inventor of wireless. The public was unaware of the vast investigations of such thinkers as Hertz and Maxwell, who were the dominant links in the long pattern of reasoning which brought forth the modern radio. Mathematics has played an important role in the development of the many commodities which make modern civilization possible, justifying the immense labors through many centuries of mathematical geniuses who had little if any thought of the applications of their discoveries.

Incorrect is the prevalent impressions among the more enlightened public that mathematicians are busy working on isolated famous problems (of perhaps questionable value), such as problems involving relations between integers (ordinary whole numbers). Impressions such as these, so easily gained from popularized accounts of mathematics, give a false picture of the existing situation, for the mathematicians as a whole are much more interested in fields than in isolated problems in these fields. Pure mathematics may be divided roughly into the following four major parts: algebra, geometry, analysis, and mathematical logic. These branches are by no mean's independent of each other, but are distinguished in the mind of the average mathematician. In each of these fields there is tremendous research activity which can be properly understood only through a thorough knowledge of these subjects. Some idea, however, of the technique of mathematical research

can be obtained without an understanding of the actual problems under investigation.

The terms algebra and geometry are already familiar to the reader. Analysis has its roots in the calculus where the concept of "limit" is dominant, while mathematical logic is concerned with the foundations of mathematics, the building of all of mathematics from a set of postulates. Pioneering work along this line was done by Russell and Whitehead in a book entitled "Principia Mathematics" (1910) before these men forsook this field for the more popular realm of philosophy.

Most highly advertised among the fields of mathematics is number theory, a subfield of algebra concerned with the properties of integers. Among the various developments in mathematics, number theory has perhaps had the least application to the other branches of mathematics and the applied sciences, but because of the fundamental nature of ordinary numbers, and the inherent beauty of many of the results obtained, the field has intrigued some of the greatest mathematicians of all time,—among them Karl Friedrich Gauss, (1777-1855) who said, "Mathematics is the Queen of Sciences, but number theory is the Queen of Mathematics."

The most famous problem of number theory is that of finding a proof for Fermat's last theorem, namely that for any integral value of n greater than 2 there are no integers x, y, z, each unequal to zero, such that $x^n + y^n = z.^n$

Thus there are no whole numbers x, y, z different from zero such that $x^3 + y^3 = z,^3$ *none such that* $x^4 + y^4 = z,^4$ etc. Since $3^2 + 4^2 = 5^2$ (that is, $9 + 16 = 25$), there are integers x, y, z unequal to zero (here $x = 3$, $y = 4$, $z = 5$) such that $x^2 + y^2 = z.^2$ Thus the value 2 for n is excluded in the statement of Fermat's theorem. This theorem, written on the flyleaf of a book of Pierre de Fermat (1601-1665) and discovered after his death, remains unproved to the present day, in spite of the claims of the statistician who recently announced to the newspapers that he had discovered a proof for Fermat's theorem while lying in a bathtub in a Buffalo hotel, and would divulge it to the person who would pay a sufficiently high price for it. Only one American mathematician, Vandiver, is actively working on this problem, and after thirty years of developing highly refined technique he has been able to prove the theorem for all values of n up to 617. Previously, the theorem had been proved true for all values of n up to 100. It is not unlikely that the proof of the validity or non-validity of Fermat's theorem will come out as a by-product of the theory of numbers when that field is sufficiently developed.

Many problems that had baffled mathematicians for centuries were solved after mathematics had reached the proper state of maturity. We recall that the length of the circumference of a circle is π "times" the length of the diameter of this circle. One of the most stubborn problems of all time was that of answering the question: Is π a quotient of two integers? One can show that the unending decimal $.3333\ldots$ is the fraction $1/3$ in the sense that the successive fractions

$$\frac{3}{10},\ \frac{3}{10}+\frac{3}{100},\ \frac{3}{10}+\frac{3}{100}+\frac{3}{1000},\ldots$$

"converge" to $1/3$. In fact one can show that a decimal number like $3.1242424\ldots$ with a repeating part (in this case 24) is an ordinary fraction. At great labor mathematicians computed π to 969 decimal places with the aid of the calculus, in the hope that they would find such a repeating block of digits. Fifty years ago Lindemann proved that π could not be written as such a quotient—in spite

of a law recently passed by a midwestern legislature to the effect that π hereafter is to be $\frac{22}{7}$.

Again it was possible to prove after algebra had reached a certain maturity, and had been applied to geometrical questions, that not every angle (e.g. *120* deg.) can be trisected by ruler and compass. This proof was accomplished after the introduction of complex numbers, based on the imaginary unit i, defined to be such that i times i is -1 ($i^2 = -1$), a radical and shocking innovation at the time.

Thus the mathematician is interested in building up fields which in turn will automatically yield the solution of well-known classical problems. Lindemann was a good but not great mathematician in comparison with such mental giants among his contemporaries as Hilbert and Poincaré, who founded entire fields of mathematics and introduced new and lasting points of view. Research mathematicians, as well as other scientists, before attacking a new problem ask themselves: "How important is it? Will the results be general enough, will they be used in other divisions of mathematics,—in short are there important applications?" Naturally, there is some variation of opinion among mathematicians as to the merits of a particular contribution, but there is unanimity with regard to the high quality of certain investigations and the low quality of others.

It is a mathematician's constant concern to fill in significant gaps in the structure of mathematics, and in so doing he is little, if at all, concerned with the possible *physical* applications of what he may accomplish. We refer here, as throughout this article, to the pure mathematician in contrast to the applied mathematician, whose primary concern is the solution of problems which have their origin in the more abstract developments of engineering and the physical sciences where these fields become completely mathematical.

Many achievements in the physical sciences and engineering have been made possible by the use of an existing development in pure mathematics. We have already noted the role mathematics has played in navigation and the radio. Albert Einstein was able to construct his general (1915) theory of relativity in part because Ricci and Levi-Civita had developed tensor analysis at least two decades before. The modern quantum mechanics of Heisenberg, announced in 1926, hinged on the use of "quantities" a and b such that a "times" b is equal to minus b times a. Matrices are such quantities, and had been studied for almost a century. In the last ten years both tensors and matrices have been applied to such things as electrical networks, elastic bodies, and structures, with remarkable success. The mathematician does not, however, lose sight of the fact that some aspects of mathematics were inspired by an existing need and were made possible by the constant development of mathmatics up to that time. Thus the field of mathematics itself was ripe for the calculus at the time it was discovered independently by Leibnitz, Newton, Fermat, and others, and it was needed immediately by Newton for the treatment of such concepts as instantaneous velocity and acceleration.

The field of modern algebra is concerned primarily with the study of very extensive generalizations of the concept of numbers with the hope that

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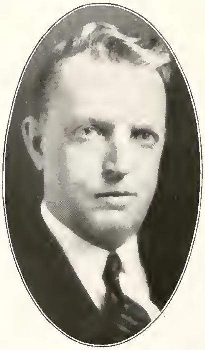
THE TECHNOLOGIST FINDS A NEW FIELD

By

FRANK A. CHAMBERS

A FEW years ago, the General Electric advertisement in one of the issues of the ARMOUR ENGINEER was illustrated with a sketch of Sherlock Holmes looking through a high-powered magnifying glass. Below this sketch, the following copy appeared, "Ah, Watson, an industrial crime. The corpus delicti—a broken resistance wire; the suspect—a defect in the wire; the detective—a micro-chemist. With microscope and analytical apparatus of incredibly small dimensions this industrial superdetective finds tiny crystal of sulphate near the break. The trail leads to a nearby furnace giving off sulphurous fumes. Thus the wire is cleared of suspicion of having been defective, and the criminal fumes are eliminated."

Well may the writer of the above copy have used exactly the same words to describe the present nature of work demanded of men engaged in the prevention of atmospheric pollution. Today municipalities, wishing to safeguard the air breathed by their citizens, must call upon the services of the trained engineer and scientist for guidance in the search for facts concerning the nature and extent of atmospheric contamination. Just as in the recent past, when the special qualifications of technologists were called upon to purify Chicago's water supply, so today, those abilities are pressed into service to prevent excessive discharge into the atmosphere of dust and noxious gases, contamination which has been aptly called "aerial sewage."



Chicago has long recognized that the services of technically trained men are needed to discover the sources and prevent the discharge of unnecessary pollutants into the air which its citizens breathe. Over twenty-five years ago, the standards of the Department of Smoke Inspection and Abatement were raised by the change in title of the personnel who directly enforce Chicago's smoke ordinance. These men had been called Deputy Smoke Inspectors prior to 1912. Recognizing that the services of trained engineers were necessary for an effective execution of plans to reduce atmospheric pollution, the title was changed to Junior Mechanical Engineer.

These engineers are called upon, in the routine execution of their work, to draw upon their basic knowledge of the fundamental sciences. Problems constantly arise that call for clear analysis and application of the laws of physics and chemistry for their solution.

One of the prime factors in Chicago's rapid growth is its proximity to a bountiful supply of low-cost coal in Illinois and nearby states. Unfortunately, coal from these areas is high in volatile content and apt to produce considerable smoke and grime when fired carelessly or in improperly adapted equipment. Years ago, public opinion demanded only a reduction of visible smoke discharged into the air. It was felt that the elimination of dense smoke would result in a clean city.

The problem of controlling visible smoke is relatively easy. Experienced operating engineers were called upon to instruct the fuel users in those firing methods and design of fuel burning equipment which would result in smokeless operation.

Today, however, the objectives of atmospheric control have been greatly enlarged. With the increase in cost of the country's best coal reserves and the advent and growing demand

ELECTROSTATIC PRECIPITATOR

This Instrument is Used for Determining the Dust Concentration in the Atmosphere. Air is Drawn into the Instrument by a Pump within the Instrument, Through the Right Angle Metal Tubes. Within the Horizontal Tube is a Large Metal Needle on Which a High Tension Charge is Placed. This Charge in turn Places a Charge on the Dust Particles in the Air and they are Attracted and Stick to the Metal Cylinder. By noting the Increase in Weight of the Cylinder the Weight of Dust Gathered is Known. As the Volume of Air Drawn in is Known by the Meter Near the Top of Vertical Tube, the Weight of Dust per Given Volume of Air is Known

for the forced-draft stoker has come a public recognition that the chimneys of many plants are discharging invisible constituents into the air. The problem of controlling the discharge from such stacks is infinitely more difficult than the control of excessive visible smoke. The services of the technically trained engineer and scientist are required to cope with this problem.

As has been pointed out, many present-day fuel-burning plants discharge excessive quantities of solid material from their stacks, without emitting much, if any, visible smoke. The methods employed at present to measure the concentration and physical composition of solids entrained in combustion gases require not only the spending of considerable time for each test, but the services of highly skilled mechanical engineers. A dust-loading analysis involves practically all of the features of a boiler-efficiency test plus a careful and proper sampling of flue gases to secure representative collection of entrained dust. When one considers that there are approximately 400,000 buildings and traveling fuel-burning units in Chicago, each with one or more chimneys, he is at once confronted with the enormous magnitude of the problem of policing these point-sources for possible violations of what may be considered permissible solid discharge. It is an easy task to make observations of a large number of chimneys in a restricted area to locate those stacks that are violating a dense-smoke law. Comparison is made in the appearance of the emission with standard shades of density portrayed on a chart. Any willing worker, having good eyesight, common sense, and judgment can be trained to be a good smoke observer. He can daily police the performance of thousands of stacks. But the responsibility of controlling the invisible discharge of dust from several hundred thousand chimneys is a gigantic task. There exists a very urgent demand for a simple method of testing dust loadings in combustion gases. The ideal test procedure should be readily adaptable to numerous stacks, take a short time to run, and not require elaborate or costly equipment. No such method exists today.

The American Society of Mechanical Engineers has recognized that "No standard or generally recognized method seems to be available for determining the adequacy of dust-separating apparatus when installed in the power plant." Accordingly, after a discussion of this problem, the A. S. M. E. Power Test Codes Committee decided to appoint a new committee

Spectroscopic and Microscopic Examination of Dust

known as Individual Committee No. 21, whose duty it would be to draft a Test Code for Dust-Separating Apparatus. A preliminary draft was prepared in 1939 and circulated for comment and criticism among engineers and air pollution authorities. Engineers of the Chicago Department of Smoke Inspection and Abatement, and the Work Projects Administration, who fortunately had been jointly engaged in an intensive study of this problem, reviewed the code and offered suggestions for improving the tentative technique recommended. A description of an analytical method using a modified impinger collecting system which, the Department believes, has many advantages was presented at the Philadelphia meeting of the American Society of Mechanical Engineers last December. Consideration of this code, with eventual simplifications, may ultimately result in a practical speedy test method. Until such time arrives, Chicago air pollution authorities, of necessity, must confine their efforts to making tests of dust concentration of relatively few stacks which are suspected of being exceptionally heavy contributors of solid matter into the atmosphere.

Simultaneously, an approach to the problem of locating those stacks which are responsible for excessive solid discharge is being made from a different avenue. Instead of making tests of dust concentration in combustion gases, thus putting the plant operator on guard, an attempt is being made to locate small areas where local conditions of excessive dust deposit occur. The chemical and physical properties of this deposited dust are being determined, cataloged and compared with similar properties of fly ash collected in the breeching, or base, of the stack of the plant or plants suspected of being the major contributors to the local dust nuisance. Thus far, routine analysis of the chemical composition of settled dust has not yielded promising results. However, encouraging facts have

Determination of Sulfur Dioxide in Air

been disclosed by the use of the microscope. Strong indications exist that each type of fuel-burning equipment imparts distinctly characteristic markings, shape, and size to the solid particles entrained in the combustion gases. Pulverized-coal burners discharge particles of ash that are small and globular in appearance. These particles appear to be fused. Spreader stokers, on the other hand, discharge relatively large particles, most of which are very jagged in appearance, resembling coke. Further research will probably disclose additional differences in appearance produced by the same type of firing equipment operating at varying furnace temperatures which may result in the possible fusion of ash particles into distinctive forms. Thus, air pollution authorities may soon discover a method of identifying what furnace conditions produced a sample of settled dust of fuel-burning origin.

A simple technique for identifying the kind of coal which produced the settled dust complained of, is being developed jointly by Work Projects Administration physical chemists and by engineers of the Chicago Department of Smoke Inspection and Abatement. The sample of questioned dust is compared with fly ash from the breeching or stack of the plant suspected of producing the nuisance. Both samples are ashed and then digested in water. The supernatant liquid is drained off and the pH of the slurry measured. This pH measurement is an index of the alkalis and alkaline earths contained in the coal ash and appears to vary widely in coals from different localities.

Thus, with improved technique, air pollution authorities may soon have an effective tool for identifying the origin of soot particles causing nuisance to the public. In effect, a "Bertillon" system of finger-printing dust is being developed. Not only may it be possible to identify the kind of fuel-burning equipment, but also the kind of coal responsible for a given dust nuisance.

The chemist is needed by Air Pollution Authorities to study the nature and extent of noxious contaminants in the atmosphere. Pollution may be caused by sulphur dioxide, hydrogen sulphide, chlorine, ammonia, volatile hydrocarbons, metallic fumes from metallurgical stacks or dust developed by storing, handling or processing construction materials. The job of the chemist is to develop simple means of measuring these atmospheric contaminants and judging whether such concentrations exist at levels above threshold intensity. As normal concentrations often run as low as a few milligrams per cubic meter, the chemists making such tests, are called upon to employ great skill and careful technique.

Since 1907, Chicago has called upon combustion engineers to develop standards of proper furnace design for efficient and smokeless fuel-burning operation. Before a new boiler can be installed in Chicago, plans must be submitted to these combustion engineers for approval. The examination of plans and inspection of fuel-burning plants as soon as they are installed has resulted in the gradual elimination of faultily designed plants which would smoke excessively.

This article should not be construed to imply that the need by air pollution authorities for the skilled expert in the operation and the installation of fuel-burning equipment has passed, but rather that the requirements of municipal authorities have been enlarged to include not only these practical experts, but also trained engineers, physicists and chemists. The services of these groups are complementary, one class supplementing the work of the other and thus producing a well rounded organization for scientifically controlling the extent of atmospheric contamination.

MODERN CARBURIZING EQUIPMENT

By

CHARLES R. SWINEFORD

SEVERAL methods of carburizing steel have been known and used for many years. The surface-hardening of low-carbon steels is accomplished by first increasing the surface content of carbon and then subjecting the steel to a sudden cooling or quenching operation in which crystals of iron carbide are precipitated in the metal surfaces. As consumer demands become more and more exacting, improvement in processing follows, until today low-cost commercial production greatly exceeds the finest craftsman's work of a short time ago. In this contention for superiority it is reasonable to assume that only the best methods survive.

One of the older methods, that of packing in carbonaceous compounds in closed containers, has been replaced largely by the more modern method of gas carburizing. In the latter it is now possible to control the time, temperature and atmosphere so that the resulting product will meet the most stringent specifications.

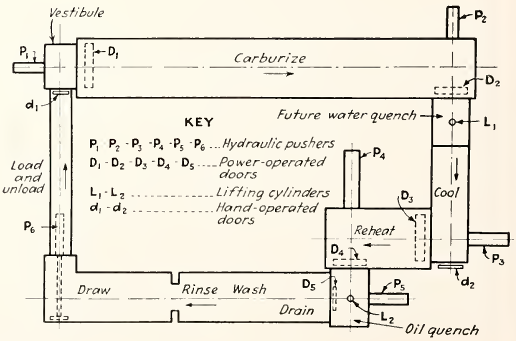
There are three methods in current use for producing the required depth of case and carbon-content by gas carburizing. In each process the steel parts are heated in a controlled gas atmosphere. In the first method a layer of soot is formed during the early stages of the heat treatment and is later removed by some oxidizing atmosphere which is supposed to burn off the excess carbon. Theoretically the removal of the soot or carbon scale should be accomplished without disturbing the carbon content of the steel. Commercial tests indicate that this method is impractical since decarbonizing of all of the surface soot usually results in the removal of part of the combined carbon at the same time. The line of demarcation between perfect soot removal and maintenance of the proper carbon content in the case is too narrow for ordinary shop control. As a result when this method of carburizing is employed, either sand-blasting or scratch-brushing is required.

In the second method an attempt is made to prevent the formation of soot by an exact control of the carbon-forming gases. This method is, theoretically, a decided improvement over the first but it involves an extremely close control of the carbon-laden gases. Exact regulation cannot be expected in any equipment for continuous production, on account of numerous practical conditions such as varying loads and varying time-cycles, as well as the excessive maintenance charge. A "carrier" atmosphere, relatively inert, is passed through the furnace. At each passage, predetermined amounts of carbonizing gases are added. thereby cooling the "carrier" gas to such an extent that contact with the hotter steel causes a precipitation of soot. The precise regulation of the raw gas entering the furnace is essential for good results but since the material is usually in the furnace for six to ten hours, considerable work passes through before a correction can be made.

In the third method, the subject of this paper, the formation of any soot or scale during the carburizing process is successfully prevented. The steel to be carburized is never allowed to be hotter than any temperature to which the gas has been previously subjected.

It has been found that both carbon monoxide and the hydrocarbons (of which methane is typical) will decompose in the presence of hot steel, giving up carbon to the metal. It is

Figure 1. Diagrammatic Plan of the Heat Treating Equipment



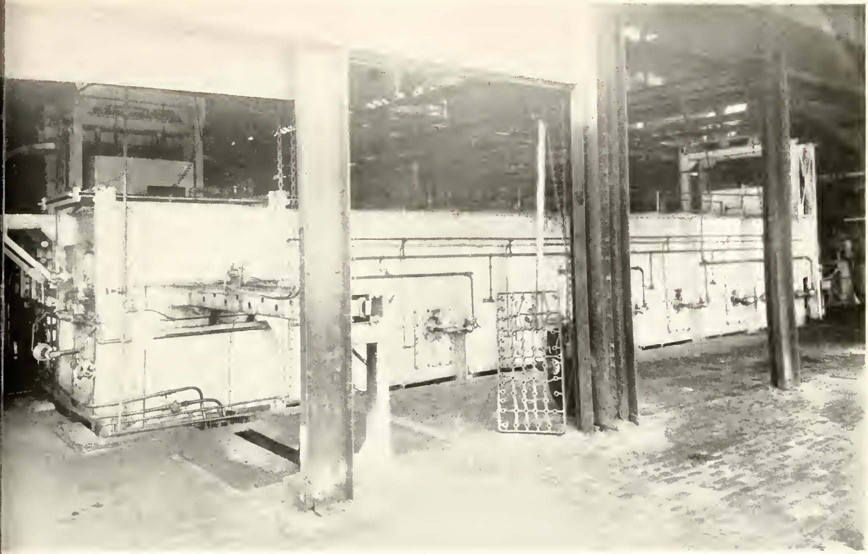


Figure 2. General View of Treating Equipment

also a fact that carbon absorbed from the gases gradually diffuses into the steel core. In order to increase the carbon content of the steel it is therefore necessary to add carbon to the metal faster than it diffuses into the core. The percentage of carbon in the case varies from a maximum in the outer layer to a minimum, the original carbon content of the steel, in the inner layer. Should the outer layer contain more than about .80 to .85 per cent carbon it is called the hyper-eutectoid layer. The succeeding layers are called eutectoid and hypo-eutectoid respectively. Accurate proportioning of the thickness of the layers is essential to meet all commercial specifications.

A complete carburizing, heat-treatment and washing plant, designed and built by The Continental Industrial Engineers, Inc., Chicago, for a large automobile manufacturer, successfully produces carburized parts without any deposit of soot or scale.

Fig. 1 shows a diagrammatic plan of the Continental Muffleless Carbonizing furnace with its auxiliaries. It will be observed that the various units are connected in such a manner that at no time are the treated parts exposed to the air. All operations are automatic, at no time requiring manual control.

A grid-tray, shown in the center of Fig. 2, carries from 250 to 350 pounds of parts. This particular form was chosen because it permitted an intimate contact between the carbon-laden gases and the steel parts, provided a free circulation of the quenching liquid when lowered into the quenching tank, and permitted compact loading and, therefore, economical heating.

The loaded trays are propelled through the entire cycle by a number of pushers, indicated in Fig. 1 by letters P1 to P6 inclusive. All pushers as well as doors, lettered from D1 to D5 inclusive, are actuated by oil-pressure of 500 pounds per square inch. The system of pushers and door-actuating devices is so interconnected by pilot valves, limit switches and interlocks as to preclude any interference in operation.

The output of the equipment is about three trays per hour or between 750 and 1050 pounds per hour. This range of output permits a considerable variety in the weights and shapes of the pieces to be carburized.

The carburizing unit, Fig. 2, a rugged steel construction, is made air-tight by continuous welding of all side plates. An efficient gasket is provided between the top and the side plates. Thirteen and one-half inches of high quality non-ferrous refractory and four and one-half inches of heat resisting blocks are provided for the side walls and arch. The inner walls are treated with a wash that prevents excessive carbon adhesion.

This furnace has many revolutionary features which have greatly extended the possibilities of gas carburizing. One of the outstanding features is its muffleless construction, the

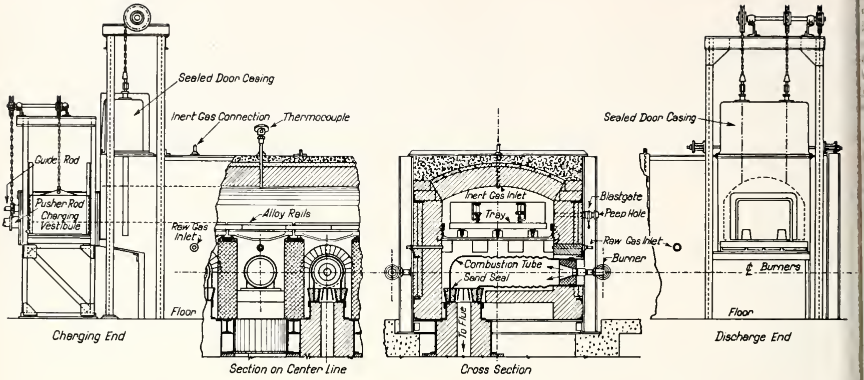


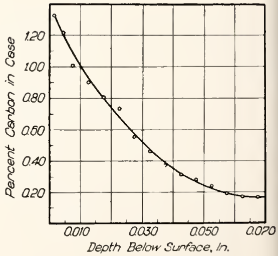
Figure 3. Above: Elevations of Carburizing Unit

Figure 4. Below: Chemical Analysis of Lathe Turnings of S.A.E. 4815-A. Samples from Regular Production

gas flame, rather than the work, being inclosed. All earlier furnaces have been constructed with muffles which enclose the work.

Fig. 3 shows a cross-section of one of the combustion tubes in which the heat is provided. The products of combustion, prevented from mixing with the carburizing atmosphere, are led through a flue to an off-gas stack. A portion of the heat in the off-gases may be by-passed and used for supplying heat in the drawing operation later in the cycle. The combustion tubes are made of high-alloy steel and are located below the rails. The design permits easy removal for repairs without the necessity of entering the furnace, and the location of the tubes below the rails provides a means of heating the raw gas to a temperature higher than that of the parts to be carburized, thus preventing the undesirable accumulation of soot or scale. If the gas has been heated to a high temperature before making contact with the steel, the carbon in the gas will be precipitated on the heating tubes instead of on the work. The temperature difference between the combustion tube and the arch is sufficient to provide strong convection currents. These convection currents, not available in the muffle-type furnace, insure quick heating and a uniform case. Raw gas may be admitted above the rails in such quantities as will produce the proper atmosphere.

The rails, upon which the trays slide, are made of nickel-chrome alloy resting on refractory piers. Ample provision has been made in the rails for expansion due to changes in temperature and for sag and creep due to repeated heatings.



A typical time-temperature table for S.A.E. 4815-A steel follows:

Heating and Carburizing	7 hours	1525 to 1690 deg. F
Cooling	80 minutes	600 deg. F
Reheating	80 minutes	1460 deg. F
Quenching	20 minutes	120 deg. F
Washing and rinsing	80 minutes	160 deg. F
Drawing	80 minutes	350 deg. F

During the seven-hour period of carburizing 4815 steel the average temperature in the first third, middle third and last third of the chamber were respectively 1440 deg. F, 1680 deg. F and 1690 deg. F. Tests on cylindrical specimens removed hourly show the following depths of case: 1 hour, .0045"; 2 hours, .011"; 3 hours, .022"; 4 hours, .032"; 5 hours, .036"; 6 hours, .0395"; 7 hours, .041".

Chemical analyses of lathe turnings taken from these cylindrical test pieces show the percentages of carbon obtained in the case corresponding to the case depths. The chart, Fig. 4, graphically illustrates this relationship.

Test pieces, pack and gas carburized, were carefully examined for variations in depth of case. Each pair of lines in the chart, Fig. 5, graphically represents variations of case depths on opposite sides of a number of samples. It may be seen that a greater uniformity exists when the pieces are gas-carburized than when carburized by the older pack-process. It is to be noted that uniformity is independent of the shape of the test pieces.

Distortion, due primarily to temperature changes, is inevitable. The proper selection of material and a careful heat treatment, however, will reduce the distortion to a minimum. For gears, in particular, lack of distortion means better performance.

In order to compare the distortion between pack and gas carburized gears after treatment, careful tests were made on the profiles of gear teeth 90 deg. apart. The averages were recorded and charted as shown in Fig. 6. Distortions up to .0005 inch occur after pack-carburizing and hardening. On the other hand, distortions of about .0001 inch occur after hardening in the heat-treating machine described in this paper. In both charts, Fig. 6, the broken lines represent the tooth profiles before treatment and the solid lines after treatment. Service tests on the gas-carburized gears show that they are superior for heavy loads, last longer and make less noise than the pack-carburized product.

The author is indebted to the Continental Industrial Engineers, Inc., for the use of the cuts and for helpful suggestions and criticisms in the preparation of this paper.

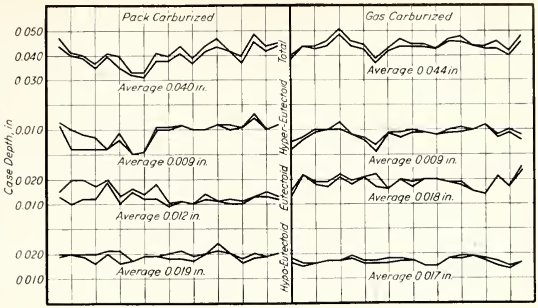
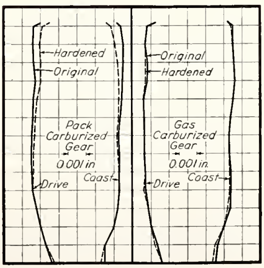


Figure 5. Above: Comparisons of Pack and Gas-Carburized Samples, Showing Case Depths

Figure 6: Below: Relative Distortions of Pack and Gas-Carburized Gear Profiles



OBITUARY

ARTHUR C. TOBIN

Armour Institute of Technology and Armour Scientific Academy, the latter no longer in existence, enrolled their first classes in 1893. Arthur C. Tobin was a member of the first class in the Academy. Until his death, which occurred February 17, 1940, Mr. Tobin retained his interest in affairs of the Institute.

From 1896 until 1905 he worked on a part-time basis for the elder Philip D. Armour. For the next two years he was employed as a construction manager for Frank Lloyd Wright. In 1906 Mr. Tobin, as a result of answering a blind advertisement, became office manager in Chicago for the General Fireproofing Company, and remained with that organization as long as he lived. He held successively the positions of sales manager, manager of the Chicago branch, and president.

MRS. ALICE MAY McCAFFREY

Few graduates of Armour are known to more of our alumni than J. Warren McCaffrey, who has been especially active in the affairs of the alumni association since 1922. Mr. McCaffrey's friends sympathize with him in the death of his mother, Mrs. Alice May McCaffrey, who died December 28, 1939. Mrs. McCaffrey was a sister of Judge Denis J. Normoyle of the Circuit Court of Cook County.

MODERN PIONEERS

By

ALEXANDER SCHREIBER

One thousand people, most of them Chicagoans, but many of them from other parts of Illinois and from Indiana, Iowa, and Missouri, assembled in the Grand Ball Room of the Palmer House Tuesday evening, February 20th, to do honor to fifty-nine men, — research workers, scientists, and inventors, whose creative ability and diligence have contributed during the past quarter-century to industrial growth and to improvement in the American standard of living. These men were cited as MODERN PIONEERS, and were given certificates in recognition of their ability and their services.

Specifically, the occasion was a commemoration of the one-hundred-and-fiftieth anniversary of the American patent system. The presentation of the Modern Pioneers awards was industry's answer to the statement that we have reached the end of the road to progress, and was in the nature of a proclamation that the day of golden opportunity for the individual still lies ahead.

The Chicago Regional Modern Pioneers' celebration was one of a series of fifteen inaugurated by the National Association of Manufacturers to honor the nation's outstanding scientists and inventors. James D. Cunningham, chairman of the Board of Trustees of Armour Institute of Technology and president of Republic Flow Meters Company, was chairman of the local committee which comprised more than eighty leaders in business and civic affairs. Armour Institute of Technology, the Illinois Manufacturers Association, and the Wisconsin Manufacturers Association, with the regional committee, were co-sponsors of the celebration.

One-hundred-and-fifty eminent inventors and research workers in this region were nominated at the request of a committee headed by Dr. Karl T. Compton, president of Massachusetts Institute of Technology. The nominations came from business groups, colleges and universities, professional societies, and others. The awarding of the certificates was the climax of this search for outstanding excellence. The requirements were as follows:

The nominee must have been engaged in the field of invention or research and must have discovered or invented an art, machine, manufacturing process, composition of matter, or useful improvement thereof upon which the United States Patent Office has issued a patent.

Furthermore, such a discovery or invention must have been put into industry. Its use must have resulted in new industries, or provided a new commodity or service, or reduced the cost or improved the quality of a product already in use.

Mr. Cunningham, chairman of the Chicago meeting, summarized the reasons for the celebration as follows:

"The pioneer of yesterday ventured into the wilderness and conquered new territory. He cleared land and made it productive. The pioneer of today ventures into the unknown fields of science and engineering, and pushes forward man's knowledge of the useful arts and sciences.

"Throughout American history, new jobs, new industries, and higher standards of living have been produced by inventions and discoveries on the frontiers of industry. The patent system, starting in 1790, has provided a stimulus not only to the inventor and research worker, but also to the manufacturer and investor. It has typified, perhaps, better than any other American institution, the American principle of reward for individual initiative.

"America is dependent upon its Modern Pioneers for new goods, new services, and new employment opportunities. All America pays tribute in the Modern Pioneer programs, instituted by the National Association of Manufacturers, to these men, creators of higher living standards, and to the patent system upon which the fruits of their genius is so dependent."

We of Armour are especially interested in the citations of four Modern Pioneers:

ALFRED L. EUSTICE, A. I. T., B. S. '07, E. E. '10. President, Economy Fuse and Manufacturing Company. Member of Board of Trustees, Armour Institute of Technology.

"Perhaps, the one thing in our lives which we fear the most—fire—has been averted to a great extent by the development of a superior electric fuse by Alfred Eustice. Too many lights burning at one time, an overheated iron, an extra radio—all may result in overloaded electric circuits—and the one safety valve, the electric fuse, goes to work to save millions of dollars each year—thanks to Mr. Eustice."

JOHN M. FRANK, President and General Manager Ilg Electric Ventilating Company. Member of Board of Trustees, Armour Institute of Technology.

"Here is a man who is responsible for making a year-round business, thus creating and giving employment to hundreds of men and women during every month of the year. His chief development is the invention of the steam unit-heater which has revolutionized the method of heating large open spaces. Thanks to Mr. Frank, a new industry was created providing a less expensive and more efficient way to do an old job and at the same time making it possible to heat many types of buildings which were not heated at all or were very inefficiently heated with stoves, salamanders or furnaces."

HOWARD L. KRUM, A. I. T., B. S. '06, E. E. '11, D. Eng. '39. Consulting Engineer, Teletype Corportion. Member of Board of Trustees, Armour Institute of Technology.

"Howard L. Krum, sole holder of twenty-five patents and joint-holder of thirty-four others in the field of printing telegraphy, has been in large

(Turn to page 49)

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THE MIDWEST POWER CONFERENCE

The Midwest Power Conference will hold its 1940 meeting at the Palmer House, Chicago, on April 9-10. The Preliminary Program, as released by Stanton E. Winston, Conference Director, and given herewith, discloses a broad coverage of the field of Power and a list of speakers preeminent in that field.

This Conference is an annual event. It is sponsored by Armour Institute of Technology with the cooperation of seven other midwestern colleges and universities and seven engineering societies. All persons interested in the field of Power are cordially invited to be in attendance. Programs containing a registration card and complete information concerning the Conference may be obtained from C. A. Nash, Conference Secretary, Armour Institute of Technology, Chicago, Illinois.

PRELIMINARY PROGRAM

Tuesday, April 9, 1940.

9:00 A. M. Registration, Palmer House, Chicago.

10:15 A. M. Opening Meeting. L. E. Grinter, Chairman.
- Address of Welcome, Loran D. Gayton, City Engineer, Chicago, Ill.
- Response for the Cooperating Institutions, Ben G. Elliott, Professor of Mechanical Engineering, University of Wisconsin.

10:45 A. M. Power Fallacies. Philip W. Swain, Editor of Power.

11:30 A. M. The Combustion Gas Turbine, A Novel Prime Mover.
- Paul R. Sidler, Resident Engineer, Brown, Boveri & Co., Ltd., of Baden, Switzerland.

12:15 P. M. Joint Luncheon with A. S. M. E. L. M. Ellison, Chairman.
- Speaker: Dale F. Reese, Vice President, Hartford Steam Boiler Inspection and Insurance Co., "Protection of Power Plant Equipment."

2:00 P. M. Small Power Plants. M. P. Cleghorn, Chairman.
- (a) Diesel Units. Herbert W. Dow, Executive Sales Engineer, Nordberg Mfg. Co., Milwaukee.
- (b) Maintaining the Optimum in Steam Generator Efficiency. Parker A. Moe, Superintendent of Power, Milwaukee Works, International Harvester Co.
- (c) Discussion.

3:45 P. M. Electrical Transmission. C. F. Harding, Chairman.
- (a) Protection of High Voltage Lines. Philip Sporn, Vice-President in Charge of Engineering, American Gas and Electric Service Corp., New York.
- (b) American Power Grids in Appraisal. P. B. Juhnke, Chief Load Dispatcher, Commonwealth Edison Co., Chicago.
- (c) Discussion

3:45 P. M. Power-Process. L. S. Foltz, Chairman.
- (a) Paper Mill Power. Grover Keeth, Chief Engineer, Marathon Paper Mills Co., Rothschild, Wis.
- (b) Power for the Refinery. R. L. Meyer, Superintendent of Utilities, Whiting Refinery, Standard Oil Co.
- (c) Discussion.

6:45 P. M. "All Engineers" Dinner. Informal. (Ladies Invited).
- Toastmaster: Alex D. Bailey, Chief Operating Engineer, Commonwealth Edison Co., Chicago.
- Speakers: F. Malcolm Farmer, President, American Institute of Electrical Engineers—"The Engineer and His Profession"; James W. Parker, Vice-President, American Society of Mechanical Engineers.

Wednesday, April 10, 1940.

9:30 A. M. Fuel Problems of Power Plants. J. C. Peebles, Chairman.
- (a) Stratification of Gases in Coal-fired Furnaces. John M. Drabelle, Consulting Engineer, Iowa Electric Light and Power Co., Cedar Rapids, Iowa.
- (b) Pulverized Coal. Martin Frisch, Chief Engineer, Boiler and Pulverizer Division, Foster Wheeler Corp., New York.
- (c) The Intermittent Burning of Gas and Pulverized Coal. H. A. Kleinman, Engineer, Peoples Power Co., Moline, Ill.
- (d) The Gas-fired Plant and Its Problems. E. L. Tindall, Superintendent, Fuel and Combustion, Carnegie-Illinois Steel Corp., Chicago.
- (e) Discussion.

9:30 A. M. Hydro Power. F. M. Dawson, Chairman.
- (a) Small and Medium Sized Hydro Plants. George P. Steinmetz, Chief Engineer, Wisconsin Public Service Commission, Madison, Wis.

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I'VE BEEN THINKING AGAIN

By

JAMES C. PEEBLES

AMONG the multitudinous conveniences that complicate our daily lives I like switches best of all. They make it so easy to turn things off when one has had enough. And so when I have read enough and heard too much, two friendly little switches come to my rescue. A snap for the reading lamp and another for the radio, and peace descends on my den. Through the window there is an unobstructed view of the heavens, where Venus, Mars, Jupiter, and Saturn may be observed in their stately march down the western sky.

There is something about the winter sky at night of which I never tire. After all the sound and fury, all the sense and nonsense that one reads and hears, there is a serenity just outside my window for which I am grateful. It promotes, it seems to me clearer thinking and sounder judgments.

In surroundings such as these I was thinking recently of some of my experiences as student and teacher. In particular, my thoughts went back to the time, a generation ago, when I was completing my course as a graduate student in engineering. One evening near the close of the college year I worked rather late in my little private laboratory, putting the finishing touches on my thesis. When my work was done I left the building and stepped out into the magic of a June night. A vagrant breeze stirred in the campus elms, and the muted voices of the leaves crooned a serenade to the night. As I walked along under the spreading branches the rays of a full moon came filtering down through a green, translucent roof, to fall in a mosaic of light and shadow on the grass beneath. Familiar buildings, viewed through the yellow wash of the moonlight, showed shapes and shadows that I had never seen before. It was not at all the campus that I knew so well.

Charmed as I was by the necromancy of the scene, my pace slowed down a bit. Gradually the realization came to me that the leaves were not the only singers on the campus that night. From far down the quadrangle lustier voices reached me, singing the songs for which the university was famous. As I came nearer I saw that a large group of students had assembled on a grassy terrace on the opposite side of the quadrangle. Then I remembered; it was the Senior Sing, one of the oldest traditions of the university. Surrounding the seniors on the terrace, but at a respectful distance, many under-classmen were gathered, with faculty members and townspeople to swell the throng.

Reaching the outer edge of the crowd I stopped at a convenient vantage point to listen to the singing. It was a beautiful and inspiring sight: the grassy terrace, the massed singers, the elms, the moonlight. For the seniors themselves the event was a bravura passage in the symphony of their college days; an event never to be forgotten. So I listened as the fresh young voices sang; battle songs, victory songs, songs of good cheer, songs of love and loyalty to Alma Mater. At last the strains of Evening Song fell like a benediction on the listening throng. When the final notes had died away there was a profound silence for a moment, far more vocal than any applause. Then the crowd began to move slowly away, still under the spell of a beautiful tradition.

The quadrangle was almost deserted when I awoke from my reverie and began to think more clearly about the scene I had witnessed. Many of the seniors, especially those from the college of engineering, I knew quite well. They were sons of well-to-do families and in many cases their homes were in small towns. Now they were just finishing four years of college in an institution located in a very small city. There being no economic urge to summer work, I know that the long vacation was spent at play in an outdoor world of woods and waters. Frankly disturbed by such consideration I began to ask myself some questions; not such pleasant questions either, and all out of harmony with the events of the evening.

"These young friends of mine, how much do they know about the world of industry into which they will soon seek entry? And what of the college course which they studied in such inspiring surroundings; has it taught them how to come to grips with reality, or have they been merely shadow boxing for four years? A boiler is an interesting piece of equipment as seen from the pages of the textbook; but when a tube blows out or an ignition arch falls would these boys know what to do? A pneumatic riveter is a marvelous labor saver but it makes an infernal racket and is not a pleasant companion. These lads have been asking for it for a long time; can they take it now?"

No such thoughts as these disturbed the boys on the night of the Senior Sing. But events of the following years showed very clearly the emotional stress and storm through which many passed before they became adjusted to the world and its work. Many times since that June night I have asked myself if we engineering educators do all we might to help the student bridge the gap between college and industry. Intellectually he is well prepared, but emotionally and psychologically? I wonder. Sometimes, I fear, we insulate him from the world during his student years, fill his last few days with song and ceremony, graduate him with the bachelor's accolade, and then send him out to dig sewers.

I would be the very last to frown on the esthetic side of college life or to disparage the memories which graduates carry away. Later when they speak of college many will say "those days were the best I have known." But as fledglings I hope they will face the world with level eye because they are not afraid.

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THE BOOK SHELF

By
ELDER OLSON

After Many a Summer Dies the Swan, by Aldous Huxley. Harper and Brothers.

Aldous Huxley has written at least some seven novels, two plays, three volumes of verse, ten books of essays and belles-lettres, and six collections of short-stories. In the course of this very considerable writing he has built up, one might say, a world of his own, in the sense in which any writer tends to construct his peculiar universe. The image which Huxley makes of the world is not a pleasant one. It contains, like the natural world, sunlight, rocks, trees, men, cities, and beasts, all vividly colored enough, all ingeniously animated; but the sunlight has a false and sinister sheen, the cities have the intricate artificiality of a movie set, and nature is—well, unnatural. As for the men and the beasts, the only distinctions between them seem to be matters of speech, dress, and a tendency on the part of the human animal to be notably less direct than his fellow-brutes in the following of instinct. Man cannot accept the facts of birth, copulation, and death as simply as, say, the baboon; he must impose fine names on all his activities, however squalid they may be; he must invent fine reasons for all he does; he must move in a mist of his own making, for by some biological sport the simple sight of the animal is denied to him. According to Huxley, that curious need of man for some sanction other than the instinct of the brute has been the genesis of all philosophy, all religion, all poetry, all logic, all history; and the function of each of

these is to provide in its own way some convenient and prettily colored fiction to mask the truths of biology which, in the end, are the sole principles of animal activity. Not a pleasant world, certainly. Mr. Huxley himself—in *Point Counter Point,* I think—raised the proper question concerning it: "How do we know that this world isn't some other planet's *hell?*"

If humanity is indeed caught in this mist of its own making, as well as in the net of nature, then, since the net is inescapable, the intelligent can avoid only the mist. There are but two solutions of man's predicament, both necessarily imperfect; science provides one, satire the other. The scientist sees man as a complex of biological errors, a curious complex, certainly, but still a biological one, and one explicable in the end to biology alone. As a consequence of this revelation, the course of science is a slow but final erasure of everything that philosophy and religion have taught. The satirist, on the other hand, must be illuminated by science until he too attains the scientific vision; but it is the office of satire to teach the stupid human animal the truths that science can only disclose.

After Many a Summer Dies the Swan is professedly a novel; but it might well be regarded as a crude and elementary narrative framework barely holding together a series ot abortive and ill-considered philosophic essays, the theses of which I have outlined above. In fact, the narrative does little more than exemplify the doctrine of the essays; it would be difficult to justify on any poetic grounds. Consider what happens in the story, and see whether you can discover any connection in the events. An English scholar, Jeremy Pordage, journeys to Hollywood to inspect the Hauberk papers, a recent acquisition of the vulgar, ignorant, and sensual Jo Stoyte, who is typical of the American multimillionaire as English novelists conceive him. Very little happens: Pordage is shocked, like all visiting Englishmen, by the vulgarity of American advertising, which can acclaim indifferently and simultaneously cemeteries, hamburgers, and Christ; he visits the most sumptuously indecent of burial grounds; he engages in long-winded discussions which I fear would not be permitted in Philosophy 101; and so on. Jo Stoyte, it becomes apparent, has two chief passions: sex and the fear of death. A researcher into the causes of longevity, one Dr. Obispo, profits by the latter; a certain Miss Virginia Maunciple, by the former. Mr. Pordage's researches into the Hauberk papers uncover chiefly two items: a collection of pornographic writings which assist the Doctor's progress with Miss Maunciple, and the Journal of the Fifth Earl of Gonister, whose ideas on the causes of longevity coincide remarkably with those of Dr. Obispo. When Stoyte discovers the affair between Miss Maunciple and the Doctor, he goes berserk and kills Peter Boone, a harmless and idealistic young admirer of Virginia's. The murder is hushed up; and the Doctor, Stoyte, and Virginia go to England where in the cellar of Gonister Castle they find the Fifth Earl still alive with his housekeeper—preserved, as the doctor had surmised, by a diet of triturated fish-entrails. This is perhaps remarkable, since the Earl is now two hundred and one years old. The Doctor considers the phenomenon sufficient proof of his theories, and prescribes the diet for Stoyte. There is a difficulty, to be sure: "the older an anthropoid, the stupider"; and the Earl and his housekeeper had become completely simian. As the party stare at the obscene performance of the aged anthropoids, Mr. Stoyte breaks silence:

"How long do you figure it would take before a person went like that? . . . I mean, it wouldn't happen at once. . . . And once you get over the first shock—well, they look like they were having a pretty good time. I mean in their own way, of course. Don't you think so, Obispo?"

That choice of a human being to live on at any cost, even though transformed into a beast—because in the end he realizes that his only real desires are the desires of the beast—is perhaps the most violent expression of cynicism we have had from Mr. Huxley. As an expression of cynicism it is ingenious enough; the difficulty, however, is that Mr. Huxley seems to feel that it is warranted, and warranted by the behavior of his characters. He forgets, if he feels thus, that a novelist selects his characters and defines their attributes; if noble characters are chosen, the universe of their action will seem noble as well; if the base are chosen, the universe will seem base. Hence I fail to understand why Mr. Stoyte's ultimate choice of bestiality should be taken by Mr. Huxley as proof of the essential bestiality of the human race; for Mr. Huxley, as a novelist, had to construct a character capable of making just that choice. But Mr. Stoyte is the creation, I should like to point out, not of God, but of Mr. Huxley. In the second place, now that we have disposed of Mr. Huxley's loaded dice, the trick of reducing all human motivation to the purely animal, and all animal activity to the chemistry of the organism, will hardly stand a second glance. Analysis of the matter will not explain the form; the closest analysis of the physical and physiological construction of the eye, for instance, will not explain seeing; and Mr. Huxley's reduction of all human action and passion to the functionings of glands will not explain human action and passion.

In *After Many a Summer,* then, we seem to have neither the truth which satire must have, nor the internal necessitation of poetry. What we do have, I think, is the peculiar personal hell which Mr. Huxley has fashioned for himself out of various misreadings of science and philosophy, and what is more serious, out of various misreadings of humanity. To paraphrase Webster's Cardinal, I am puzzled by one question about this hell: it seems a strange one, since it is justifiable neither as an instrument of divine retribution, as was that of Dante, nor as a place in which, although most bitterly, some nobility might be won.

Christmas Holiday, by W. Somerset Maugham. Doubleday Doran and Company, Inc.

Modern writers have apparently so great a fear of being taken for mere plot-makers that they will employ any device to obviate that danger. Their fear is a perfectly intelligible one, of course; it grows out of a feeling in the nineteenth century that character is more important than action, and that a plot is either a mere formula—a kind of recipe—which any writer good or bad might follow readily enough, or else a product of perverted artifice. I will not deny that this affright has had some very happy consequences; on the other hand, I think, it has imposed much greater limitations upon authors than a plot would have done, to the ruin of many an otherwise excellent work.

Mr. W. Somerset Maugham's new novel, *Christmas Holiday,* is a case in point. The story is so slight that I suspect it should never have been a novel at all—with a little economy it might have made a stunning short story; but to have contracted it so would have been to reveal that it had a *plot.* Mr. Somerset Maugham avoids this horrid possibility by every device he knows (not very many, incidentally!) with the result of pretty nearly complete incoherence. Let me show you what I mean. The real story is this: a young Englishman of prosperous and conventional family is sent to Paris by his father for a

(Turn to page 50)

HELP! HELP! HELP!

By

JOHN J. SCHOMMER

Are you working? Do you wish a change of employment? Do you want more responsibility? Are you ambitious? Whether or not you are now working and permanently employed, it may pay you handsome dividends to keep your placement record, with a photograph attached, up to date in the Placement Department. This solicitation applies to you old grads as well as to you recent Tech Hawks. Every one of you should be "finger printed" in our files. If your record is not on file, send in a request for a form and it will be mailed to you immediately. Every quarter some one or two alumni are placed in splendid positions with excellent futures involving more money and responsibility. Are you interested in these positions?

Wanted, a Mechanical Engineer to take charge of a power plant outside of Chicago. Must be able to mingle with his fellow employees without friction. Minimum age thirty-five years, salary $3600 a year or more, depending upon the man.

Wanted, an Electrical Engineer for operation of distribution station, interior and exterior lighting. Age must not exceed forty-five so that engineer employed may be eligible for pension after twenty years of service. Salary, $5000 to $6000 per year.

Wanted, a Mechanical Engineer for supervision of power plant with large central heating plant and care of mechanical and automotive equipment. Salary will be from $5000 to $6000 a year.

Wanted, a young man recently through school to act as assistant to the vice-president of a steel company. This executive is chiefly occupied with metallurgical problems. Therefore, any background in this field will be very helpful, although not essential. A knowledge of stenography would also be an advantage. The salary will be from $100 to $125, but that should not be the main consideration. The executive whom this man will assist is one of the leading metallurgists of the country and this represents an unusual opportunity for the right man far beyond any monetary consideration. The individual must be of the alert, energetic temperament, leaning more toward the sales type rather than research or production. This will also be an excellent stepping stone to sales work or other executive responsibilities.

Wanted, a man to act as assistant to the manager of a department of a large company. This manager is responsible for branch operations and desires a man with experience in a branch organization, office work, etc. This, again, is an unusual opportunity. The salary will be in the neighborhood of $300 to $350.

As time goes on there are going to be many more requests of this kind involving better salaries and greater responsibility.

Men are constantly losing or changing their jobs, depending on business conditions. The list of unemployed "grads" changes from day to day. Last December there were twenty-one Armour Tech engineers placed, in January there were twenty-six, and in February, twenty placements were made. In addition there were numerous part-time holiday jobs given our students.

The 1940 Class will soon be up for their sheep-skins. There will be approximately 175 of them, barring unforeseen accidents. They need work. Thus far there have been representatives from seventeen industrial firms on the campus. More recruiting interviews are scheduled for March. You can help if you will inform this department of any vacancies you have in your company, or that you hear of, in which an Armour senior may be placed.

In addition to the 175 bachelor's degrees there will be twenty-five master's degrees and one doctor's degree. If you need men with advanced training, here is your chance.

If you have made a change in your

(Turn to page 37)

THE ANNUAL GIFT PROGRAM

The Armour Institute of Technology annual gift fund was begun in 1939. It was not a new idea. The first group of alumni to serve their alma mater in a substantial manner was from Yale University. That band of pioneers began in 1890 to raise money amongst themselves and from friends of Yale in annual subscriptions. They began slowly at first and with accelerated speed this group have raised $150,000 a year for a number of years. During an intensive drive for funds in one year they piled up over $20,000,000 for the Yale fund.

Our alumni organization under the chairmanship of J. Warren McCaffrey last year raised about $4,000. This was allocated by your Board of Managers to pay for the furnishings of the Student Union. All yearly alumni subscriptions will be spent for Armour Institute of Technology as directed by your Board of Managers after ascertaining the essential needs of Armour Tech. The amount needed was $10,000. Six thousand more is needed. The furnishings were essential for the comfort, recreation facilities, and increase in study space for the student body. It may interest you to know that the undergraduate, the graduate, and evening school number nearly 4000.

Since $6,000 more is needed, it is the desire of your alumni board of managers that those of you who signed yearly pledges to send in your donations do so in the very near future. To those who did not sign a pledge card, it is earnestly requested that you do so.

If capitalistic institutions are to survive, it is imperative that they receive the support of their alumni and their friends. Won't you do it now and send in your subscription?

ALUMNI BOARD OF MANAGERS.

Editor's Note: The final report of Mr. McCaffrey, Chairman of the Annual Gift Program Committee for the past school year, appears on the next page.

CLASSIFIED ADVERTISEMENTS

REPORT OF CHAIRMAN OF ANNUAL GIFT COMMITTEE

277 Alumni Subscriptions	$2121.50
67 Alumni Contributions	952.50
7 Miscellaneous Gifts	1472.30
Total	$4546.30
Average of Subscriptions, Contributions and Gifts	$ 12.95

SUBSCRIPTIONS AND CONTRIBUTIONS OF ALUMNI BY CLASSES

Year	Subscriptions	No.	Contributions	No.	Subscriptions & Contributions	No.	Averages
1897	$ 75.00	4	......	..	$ 75.00	4	18.75
1898	26.00	4	$ 55.00	2	81.00	6	13.50
1899	10.00	1	10.00	1	20.00	2	10.00
1900	5.00	1	......	..	5.00	1	5.00
1901	......	..	......	..	......	..	....
1902	57.00	5	10.00	1	67.00	6	11.17
1903	40.00	4	20.00	1	60.00	5	12.00
1904	10.00	1	20.00	1	30.00	2	15.00
1905	50.00	2	......	..	50.00	2	25.00
1906	140.00	4	5.00	1	145.00	5	29.00
1907	29.00	3	......	..	29.00	3	9.67
1908	83.00	4	40.00	2	123.00	6	20.50
1909	......	..	......	..	......	..	....
1910	2.50	1	15.00	1	17.50	2	8.75
1911	42.00	7	10.00	1	52.00	8	6.50
1912	35.00	2	121.00	4	156.00	6	26.00
1913	25.00	4	110.00	2	135.00	6	22.50
1914	28.00	4	75.00	2	103.00	6	17.17
1915	50.00	3	36.00	3	86.00	6	14.33
1916	51.00	4	25.00	1	76.00	5	15.20
1917	75.00	7	35.00	2	110.00	9	12.22
1918	55.00	5	2.00	1	57.00	6	9.50
1919	......	..	......	..	......	..	....
1920	15.00	2	......	..	15.00	2	7.50
1921	9.50	3	57.50	3	67.00	6	11.17
1922	107.00	12	15.00	2	122.00	14	8.71
1923	54.00	8	10.00	2	64.00	10	6.40
1924	40.00	7	15.00	2	55.00	9	6.11
1925	84.00	14	......	..	84.00	14	6.00
1926	32.50	6	5.00	1	37.50	7	5.36
1927	60.00	8	17.00	4	77.00	12	6.42
1928	30.00	6	1.00	1	31.00	7	4.43
1929	135.00	20	15.00	2	150.00	22	6.82
1930	59.00	11	20.00	3	79.00	14	5.64
1931	66.00	11	10.00	2	76.00	13	5.85
1932	89.00	16	10.00	1	99.00	17	5.82
1933	71.00	19	2.00	1	73.00	20	3.65
1934	83.00	10	50.00	3	133.00	13	10.23
1935	43.00	7	47.00	4	90.00	11	8.18
1936	81.00	17	1.00	1	82.00	18	4.55
1937	62.00	8	45.00	5	107.00	13	8.23
1938	67.00	18	8.00	2	75.00	20	3.75
Faculty	45.00	4	35.00	2	80.00	6	13.33
Totals	$2121.50	277	$ 952.50	67	$3074.00	344	(8.94)

Average Subscriptions ....$7.66 Average Contributions $14.22

Respectfully submitted,

J. WARREN McCAFFREY, Chairman.

HELP! HELP! HELP!

(From page 35)

employment since you sent in your record, let us have the information so that your file may be up to date. The Alumni Office will be notified of the change of employment and address.

Service to the prospective employer is impaired or made impossible if you do not follow up a lead and report the outcome; the Placement Office in this way loses efficiency and gets a bad name. Service to the applicants is impossible if no records are made. A man may keep another man out of a position by following a lead and not reporting details. Cooperation will help the department in selecting the openings of real value. A man reporting an unsatisfactory opening saves us the time of recommending other men and helps us to protect our applicants.

John J. Schommer,
Director of Placement.

FROM YEAR TO YEAR

A RECORD OF ARMOUR ALUMNI AROUND THE WORLD

By

A. H. JENS, '31

1897

Moskovics, Frederick Ewan, M.E., who is Pres. of the Roto Shaver, Inc., recently moved to Riverside, Conn.

1904

Hammond, Ray W., E.E., has changed his address to 947 11th Street, Santa Monica, Calif.

Judson, Ross W., M.E., has changed his address to 1526 Union Guardian Building, Detroit, Michigan.

1905

Hill, Warren Edwin, M.E., who is Director of the Washburne Trade School, recently moved to 7456 South Shore Drive, Chicago.

1906

Hayes, Charles Edward, M.E., has changed his home address to 4300 Roosevelt Way, Seattle, Wash.

1907

Cole, Arthur J. E.E., who is Pacific Coast Manager for the McGraw Electric Co., recently changed his address to 1510 S. Santa Fe Ave., Los Angeles, Calif.

Lurvey, David, E.E., who is with the Hatfield Electric Co., Inc., recently changed his address to 5417 N. Meridian Street, Indianapolis, Indiana.

Thompson, Morris, C.E., who is a salesman for the Insured Estates, recently changed his address to 2057 S. 29th St., Milwaukee, Wisconsin.

1908

Botteron, Clarence Irvin, Arch., now resides at 4005 Main Street, East Chicago, Indiana.

Guerin, James, C.E., is now residing at 1128 North Shore Avenue, Chicago, Ill.

Monahan, Joseph Edward, M. E., has changed his address to 351 Indiana, N.W., Grand Rapids, Michigan.

Pollak, Ernest, C.E., recently changed his address to P. O. Box 1702, Orlando, Florida.

1909

Anderson, Harry Clifford, C.E., who resided in Little Rock, Arkansas, passed away on November 12, 1939, after a brief illness. For many years Mr. Anderson had been stationed with the U. S. Army Engineers at various posts in the west. He is survived by his widow and a son, Ray R. Anderson.

1910

Kloman, Roy S., C.E., who is Asst. Engineer, Board of Local Improvements, City Hall, has changed his address to 2551 Farwell Ave., Chicago, Ill.

Harold S. Ellington

In a special issue of *The Foundation*, published by the Engineering Society of Detroit, is included an account of the design of the Horace H. Rackham Educational Memorial which is to house the University of Michigan Extension Service and the Engineering Society of Detroit. Harley and Ellington were appointed Architects and Engineers for this unusual project and in summing up the results of their study the following comment is made:

"Your Committee believe that the Architects have succeeded in designing a building in keeping with the magnificence of the gift, which will be an inspiration to the engineers of Detroit. In accomplishing this purpose they have made possible the erection of a fitting memorial to the late Horace H. Rackham. And this is as it should be."

Mr. Ellington is a graduate of the Class of '08 in the department of Civil Engineering. He was nominated to the Board of Trustees of Armour Institute by the Alumni Association in June, 1938 and was later elected to the Board.

1912

Strong, Paul A., E.E., who is Plant Manager for the R.C.A. Mfg. Co., recently moved to 839 Stratford Ave., South Pasadena, Calif.

Whiting, Bruce Ingalls, E.E., recently changed his address to 6022 S. Kenwood, Chicago.

1914

Barber, Gordon Stanley, Arch., is now residing at 5906 13th St., N.W., Washington, D. C.

DeCelle, Oliver A., Ch.E., who is Vice President of the International Filter Co., recently changed his address to 325 W. 25th Place, Chicago.

1915

Gleason, Charles E., M.E., has recently changed his address to General Delivery, Santa Monica, Calif.

1916

Altman, Eugene Emanuel, C.E., is now residing at 6550 N. Ashland Ave., Chicago. He is connected with Felton & Son, Inc. of Boston, Mass.

1917

Benjamin, Abraham Sundahl, E.E., who is Sales Engineer and Advertising Manager for the Teletype Corporation, now resides at 4609 N. Monticello Ave., Chicago.

Hufer, Harold T., Ch.E., who is a General Counsel for the National Tea Company, has moved to 1219 E. 72nd St., Chicago.

Kula, Joseph Stanislaus, F.P.E., who is with Marsh. McLennan, has moved to 6161 N. Nagle Ave., Chicago.

Mease, Archibald John, Ch.E., who is with the E. I. duPont de Nemours Co., New York, has moved to 159 Boulevard, Glen Rock, N. Y.

Mowry, John K. Arch., who is Construction Supervisor, U. S. Engineers, War Dept., has changed his address to 100 Rolling Road, Baltimore, Md.

Newman, Joseph, J., Ch.E., has changed his address to 1440 S. Pulaski Road, Chicago.

1918

Crown, Victor Max, C.E., who is an instructor at Lane Tech. High School in Chicago, recently changed his home address to 6229 N. Talman Ave., Chicago.

1919

Greenspahn, Allan Haskell, M.E., who is Asst. Supt. with the Credential Life Ins. Co., recently changed his home address to 6308 N. Bell Ave., Chicago.

1920

Lewis, Benjamin Wolf, Ch.E., who is a salesman with Wishnick Tumpeer, Inc., has changed his address to 5414 E. View Place, Chicago.

Lyon, Arthur LeRoy, Ch.E., who is Chief Chemist for Northwestern Malt & Grain Co., recently moved to 1626 W. 79th St., Chicago.

Vogt, Emil G., Ch.E., who is a Chemist with the Armstrong Paint & Varnish Co., recently changed his addresses to 4405 N. Winchester, Chicago.

Weinshenker, Reuben S., M.E., recently moved to 4448 Berkeley Ave., Chicago.

1921

Burness, Phillip E., Ind. Arts, who is an instructor at the Wright Jr. College, is now residing at 5353 Potomac Ave., Chicago.

Rosback, Lee Henry, C.E., recently moved to 2731 Crosley, Dormont, Pa.

1922

Gray, Wallace Taylor, Ch.E., who is with Becton-Dickinson Co., has recently changed his home address to 102 Vreeland Ave., Rutherford, N. J.

Nurczyk, Frank, M.E., recently changed his address to 6011 Gunnison St., Chicago.

Sloan, Arthur H., E.E., according to recent announcement, was married on Sept. 7, 1939, to Miss Dorothea Sklare. Sloan is a salesman with the Williams Oil-O-Matic Heating Corporation, in Chicago.

Swenson, Henning Melville, M.E., recently moved to 6154 N. Hermitage Ave., Chicago.

1923

De Bra, Eugene Field, C.E., who is with Carson & Cravens in Torrance, Calif., recently changed his address to 1509 Cabrilla, Torrance, Calif.

Johnson, Harold W., C.E., who is Superintendent of the Northwestern Foundry Co., has changed his address to 4200 Ellington Ave., Western Springs, Ill.

Kaye, Leroy A., M.E., who is a Sales Engineer with the Acme Steel Co., has moved to 100 Lawrence Ave., Tuckahoe, N. Y.

Mandell, David R., C.E., has changed his address to 2234 Oak Park Ave., Berwyn, Ill.

Misura, Charles A., M.E., who is a Construction Engineer for W. E. Callahan Construction Co., Dallas, Texas, has changed his address to 4517 Emerson, Dallas, Tex.

Myers, Christian M., C.E., who is a sales engineer for Jos. T. Ryerson & Sons, Inc., has moved to 9247 S. Marshfield Ave., Chicago.

Rutishauser, Donald E., M.E., recently moved to 2009 Broadway, Galesburg, Ill.

Skolnick, Emanuel, Ch.E., who is a Ventilation Engineer for the Board of Health Chicago, recently moved to 4615 N. Lawndale, Chicago.

1924

Greenfield, Theodore, Ch.E., recently changed his home address to 3001 Bellwood Ave., Cincinnati, Ohio.

Hanson, Everett Hart, Ch.E., who is an Industrial Engineer with the Standard Oil Co. of Indiana at Whiting, Ind., has changed his address to 9806 S. Bell Ave., Chicago.

Heartstedt, O. Edmund, C.E., recently changed his home address to 7930 N. Lowell Ave., Niles Center, Ill.

Kautz, Clarence F., Ch.E., who is a Safety Engineer with the Ethyl Gasoline Corp., recently changed his address to 1713 Beverly St., Wichita Falls, Tex.

Messer, David Lewis, M.E., recently wrote to the Alumni Editor and enclosed a program of the Rockford Meeting of the Illinois Society of Engineers. Several of the Institute professors presented parts of this program and some reminiscing was done at the close of the session. Messer is an engineer with the Illinois Bell Telephone Co., and is now located at 2429 Benderwirt Ave., Rockford, Ill.

Poole, Frederick M., C.E., who is with the Bureau of Agricultural Engineering, Drainage Rehabilitation, recently changed his address to S. C. S. Camp, Portland, Ind.

Quayle, Lloyd R., C.E., who is with the Fruit Industries, Ltd., recently changed his address to 110 Essex Ave., Glen Ridge, N. J.

Rosnick, Louis M., Ch.E., who is a Ventilation Engineer for the Health Department of Chicago, recently moved to 1423 S. Springfield Ave., Chicago.

Thoelecke, Louis C., F.P.E., who is Metropolitan Dept. Manager for the Norwich Union Fire Ins. Society, was elected chairman of the Western Conference of Special Risk Underwriters.

1925

Kraus, Leon S., Ch.E., who is Chemist and Supt. of the Greater Peoria Sanitary District, has changed his address to 510 Albany, Peoria, Ill.

Marschall, Peter J., E.E., who is Sales Engineer for Kroeschell Engineering Co., recently changed his address to 2009 Greenwood Ave., Wilmette.

Nedved, Elizabeth Kimball, Arch., recently moved to 4319 2nd Road N., Arlington, Va.

Odenwaldt, Eugene William, M.E., recently received special recognition as the outstanding manager of the six Class B plants of the U. S. Gypsum Co.

Taylor, George J., E.E., on December 18, 1939, wrote in part to President Heald, from Nela Park, Cleveland, Ohio, as follows:

Dear Mr. Heald:

It afforded me a great deal of satisfaction to receive your letter back in October advising of the consolidation of the Armour Institute of Technology and the Lewis Institute. Such a merger will result in everything you expressed in your letter, and certainly should please the Alumni of both schools.

The name "Illinois Institute of Technology" is very well chosen and should, if anything, be a valuable asset to the new school.

Considering the new ideas of operation in terms of the objective planned, there can be little doubt in the minds of any that the new institution will eventually rate among the best, if not the best. We of the Armour group, who have graduated for some time now, congratulate you and those responsible for this important move. I am sure that you can depend upon the cooperation of every Armour alumnus to aid in whatever way they can to make the new school a great monument of better education. This support, together with the excellent Board of Trustees, should make an achievement of this nature relatively simple.

It seems odd, just about the time you were entering into the agreements of a consolidation, my company was also involved in discussing the same subject. The result of this discussion was the consolidation of the General Electric Vapor Lamp Company with the Incandescent Lamp Department of the General Electric Company. The new company will be known as General Electric Company, Lamp Department. Details of my transfer (see below) from Hoboken to Nela Park, and the new activities which I will follow, are set down in a transfer release which I herewith enclose.

I should like to take this opportunity of wishing you a very Merry Christmas and trust that the New Year will be most successful to the newly organized Illinois Institute of Technology.

With kindest regards to you and my many friends at Armour.

Cordially yours,

George J. Taylor.

[Ed. Note: The following information was taken from a Special Bulletin released by the General Electric Company.]

George J. Taylor, formerly commercial engineer for G. E. Vapor Lamp Company, Hoboken, N. J., until its recent merger with the incandescent lamp division to form the G. E. Lamp Department, has been transferred to the Nela Park Engineering Department, Cleveland.

In his new work, Mr. Taylor heads up industrial lighting activities, giving special attention to practical application of lamps to illumination of factory areas.

For two years, Mr. Taylor was employed by Cooper-Hewitt Company in Chicago. His work was confined largely to service and sales engineering. For five years he served as designing and estimating engineer for the G & W Electric Specialty Co. of Chicago. During the last six and a half years, Mr. Taylor was associated with the G. E. Vapor Lamp Company at Hoboken, where he was in charge of the commercial

ALUMNI DIRECTORY

There are available to those paying up dues or purchasing a Life Membership, a few copies of the Alumni Directory. Write for additional information to W. N. Setterberg, Secretary - Treasurer, Armour Alumni Association, 3300 Federal Street.

INFORMATION

Organization of the anniversary classes of the five year periods beginning with 1900 is now under way. Members of each of the five-year classes, commencing with 1900 should write to the Alumni Office for information regarding the reunion plans for their particular class. It is intended that all activities culminate in the Alumni banquet to be held on June 4, 1940.

TWENTY-FIFTH ANNIVERSARY

Organization of the 25th anniversary reunion of the Class of 1915 is in the hands of the following committee:

Mechanical Engineers: Oscar A. Anderson and Fred L. Faulkner.
Fire Protection Engineers: Walter H. Rietz.
Chemical Engineers: Robert L. Wilson.
Architects: Stanley A. Wolfrum.
Industrial Arts: Bradley S. Carr.
Civil Engineers: Claude A. Knuepfer.

engineering department. In the East, he was an active member in numerous electrical societies and civic clubs.

Mr. Taylor is married and is the father of two daughters, one six years old, the other eleven. The new family residence is at 1540 Middleton Road, Cleveland Heights, Ohio.

1926

Alexander, Isadore Edmond, Arch., who is a member of the firm of Alexander & Brandt, recently changed his home address to 1755 E. 55th St., Chicago.

Berman, William, Ch.E., who is a Chemical Engineer with the Cuneo Press, Inc., is now living at 6440 N. Claremont Ave., Chicago.

Hatch, Edward Benjamin, Jr., F.P.E., who is a Regional Engineer with the Continental Ins. Co., has changed his home address to 1918 Wrocklage, Louisville, Ky.

Hughes, Clinton Martens, F.P.E., has changed his address to 175 W. Jackson Blvd., Room 1230-A, Chicago.

Orwicz, Bernard, Ch.E., who is Senior Chemist for the Sanitary Board of Chicago, recently moved to 2939 Division St., Chicago.

Patterson, William James, E.E., who is an engineer for Swift & Co., recently moved to 437 S. Spring, LaGrange, Ill.

Pollock, William J., Ch.E., who is Chemist in Charge of Laboratory for Phoenix Metal Cap Co., recently moved to 5339 N. Hoyne Ave., Chicago.

Woodfield, George E., Jr., F.P.E., who is State Agent for the Fireman's Ins. Co., has recently moved to 2107 Overbrook Road, Lakewood, Cleveland, Ohio.

Zimmerman, Alexander Harry, Ch.E., who is a Ventilating Engineer for the Chicago Board of Health, recently moved to 6259 N. Francisco Ave., Chicago.

1927

Beckman, Clifford A., E.E., who is a salesman for the Visking Corporation, now resides at 46 Jewett Parkway, Buffalo, N. Y.

Burcky, Charles W., E.E., who is an Engineer with the Teletype Corp. in Chicago, has recently moved to 1420 S. Crescent, Park Ridge, Ill.

Holinger, Carl J., Ch.E., has changed his address to 1008 E. 7th Ave., Plainfield, N. J.

Millott, Arthur Thomas, M.E., recently moved to 224 Oakwood Road, Interlachen Park, Hopkins, Minn.

Steinhaus, Frederick C., Arch., who is Chief Draftsman for Edgar A. Stubenrauch, Arch., recently changed his address to 129 Long Court, Sheboygan, Wis.

Swinson, Harold Arron, F.P.E., who is with the Michigan Inspection Bureau, recently moved to 16926 Snowden, Detroit, Mich.

Swanson, Robert C., Arch., recently moved to 6443 N. Minnehaha, Chicago.

Wolosewick, Francis E. C.E:, who is with the Universal Oil Products Co., recently moved to 4055 Melrose St., Chicago.

1928

Bach, Abel Whitner, M.E., who is an Engineer with the International Harvester Company, is now residing at 9027 S. Ada St., Chicago.

Even, John T., F.P.E., was recently made Special Agent and Engineer to cover the Chicago metropolitan fields for the Fireman's Fund Fire Ins. Co. He was formerly Staff Engineer.

Fabian, Henry, Ch.E., who is Assistant Chief Chemist of the Institute of American Meat Packers, recently changed his home address to 8208 Perry Ave., Chicago.

Henry, Arthur William Jr., F.P.E., is residing at 17409 Wisconsin, Detroit, Mich.

Hieber, Paul, C.E., who is with the Illinois Division of Highways, has changed his address to Harvard, Ill.

Kratokvil, Frank Michael, E.E., has changed his address to 518 Federal Bldg., Buffalo, N. Y.

Reynolds, Marshall E., E.E., recently moved to 1638 N. Humboldt Ave., Chicago.

Straits, William F., C.E., who is a Construction Superintendent for R. C. Wieboldt Co., recently moved to 852 W. 76th St., Chicago.

Vander Molen, Clarence T., C.E., who is a Service Engineer for the International Filter Co., recently changed his address to 325 W. 25th St., Chicago.

1929

Blume, Ernest Adolph, F.P.E., who is connected with the Fire Underwriters Inspection Bureau in Minneapolis, Minn., now resides at 4016 Drew Ave., S., Minneapolis, Minn.

Brunstrum, Lawrence C., Ch.E., recently changed his address to 10707 Avenue B, Chicago. He is employed with the Standard Oil Co. in Whiting.

Buggy, William J., F.P.E., who is State Agent for the Automobile Ins. Co., has changed his address to the 3rd floor, Investment Bldg., Washington, D. C.

Craig, Charles C., C.E., who is an Engineer with WPA, recently changed his home address to 518 E. 7th St., Newton, Kans.

Ericksen, Arndt Francke, Arch., who is a Sales Engineer with the Hoffman Combustion Engineering Co., recently changed his address to 663 Highland, Glen Ellyn, Ill.

Ewing, Norval Scott, E.E., recently changed his home address to 15 Esmond Place, Tenafly, N. J.

Gedelman, Fred George, F.P.E., who is an engineer with Eliel & Loeb Co., has changed his home address to 4332 N. Hermitage Ave., Chicago.

Gerstel, Leonard, E.E., has recently changed his home address to 5330 Harper, Chicago.

Guenther, R. J., E.E., who is with the Bell Telephone Co., of New York City, has recently changed his home address to Box 74, Murray Hill, N. J.

Kernan, J. Melvin, C.E., now resides at 3641 Lynnfield Rd., Cleveland, Ohio.

Lutz, Harold Rudolph, Arch., who is a designer and draftsman for Elmer Marx, Arch., recently moved to 6246 Greenview, Chicago.

McDonald, Norman, M.E., has recently moved to 2516 Green Bay Rd., Evanston.

Nissen, Harry Charles, C.E., who is a draftsman for Chance Vought Aircraft Corp., recently changed his address to 1487 Huntington Turnpike, Nichols, Conn.

Ong, Floyd Clifton, E.E., who is an Engineer with the Bell Telephone Laboratories, recently changed his address to Box 113, Convent, N. J.

Rutt, Edward Francis, C.E., who is a Junior Engineer in the U. S. Engineers Office, recently changed his address to 3012 W. 12th St., Little Rock, Ark.

1930

Beal, Chas. J., F.P.E., who has been an Engineer with the Service Department of the Royal-Liverpool Group of Insurance Companies in Chicago, has recently been appointed Special Agent for the same group of companies in Northern Illinois. Beal's headquarters will be at Elgin, Ill.

Falconer, Robert Reid, Arch., who is Controller with Holabird & Root, recently changed his home address to 1609 Dobson, Evanston, Ill.

Garen, Donald Reese, M.E., has recently changed his address to Franklin & Grove, Rockton, Ill.

Jones, Charles H., F.P.E. We are informed that the Jones' are the proud parents of a baby boy.

Kaye, Sigmund Edward, F.P.E., who is Engineer for the Western Factory Ins. Assn., now resides at 6334 Bancroft Ave., St. Louis, Mo.

Maras, John, Arch., who is General Designer for the Illinois Planning Commission, recently changed his address to 5149 Schubert Ave., Chicago.

Martin, Arthur Thompson, Ch.E., recently moved to 1685 Hogue Ave., St. Paul, Minn.

Meck, John S., E.E., recently moved to 1313 W. Randolph St., Chicago.

Ransel, John E., F.P.E., who for the last three years has been a Special Agent with the Home Insurance Company of New York recently joined the Gregory & Appel Agency in Indianapolis.

Rowley, Edward Robert, M.E., has been moved to the main office of the National Lead Co., and now resides at 217 Waller Ave., Hasbrook Heights, N. J.

Simmons, C. H., M.E., who is an Engineer for the Sinclair Refining Co., recently changed his address to 102 152nd St., Calumet City.

Sommerville, Charles T., Arch., recently changed his address to 7720 S. Wood St., Chicago.

Swanson, Ray B., F.P.E., who was formerly with the Fire Underwriters Inspection Bureau in Minneapolis is now Special Agent with the Home Insurance Co. and has headquarters at Fargo, N. D. Announcement in the October issue under the name William B. Swanson was in error. His home address is 1217 14th St., Fargo, N. D.

1931

Berger, Irving Maurice, C.E., who is connected with the War Department in the U. S. Engineer Area Office is now located at 18 S. Vernon St., Princeton, Ill.

Filmer, James Coleman, E.E., who is with the General Electric X-Ray Company, has changed his address to 925 Stoddard Ave., Wheaton, Ill.

Griesman, Albert H., F.P.E., who has been traveling North Dakota as a Special Agent for the Great American Group of Fire Insurance Companies, has recently been transferred to Minneapolis, where he will have similar duties.

Kutteruf, Robert H., F.P.E., has recently moved to 141 Trapelo Road, Belmont, Mass. Bob is still with Boit, Dalton & Church, Insurance Agents operating in the Boston vicinity.

Larsen, Carl Albert, C.E., who is Senior Engineering Aide, Bureau of Construction & Repair, Washington, D. C., has changed his address to 4994 Newport Ave., N.W., Washington, D. C.

Lukey, Myron, E., E.E., who is with the Public Service Co. of Northern Illinois, has changed his addressed to 12943 Elm St., Blue Island, Ill.

McLaughlin, Berlyn Gray, C.E., has changed his address to 447 N. Michigan Ave., Villa Park, Ill.

Miller, Clarence H., C.E., who is with the War Department, U. S. Engineers, Missouri River Division, has moved to 4200 Walnut St., Kansas City, Mo.

Minx, Emil J., Arch., recently moved to 1646 Farragut, Chicago.

Munch, Fred T., M.E., who is now with Lever Brothers, has changed his address to 10825 Indiana Ave., Chicago.

Podlipec, Frank, Ch.E., who is with the Barrett Co., recently moved to 824 Edgewater Ave., Ridgefield, N. J.

Spalding, Frank, W., F.P.E., who is an inspector for the Illinois Inspection Bureau, recently moved to 214 N. Elmwood, Peoria, Ill.

Wilson, Robert N. F.P.E., who is a State Agent with the America Fore Group of Fire Insurance Companies in Ohio, has recently changed his address to 64 Fourth Ave., Berea, Ohio.

1932

Abendroth, Harold F., E.E., who is connected with the Western Electric Company, recently changed his Chicago address to 5152 Lowell Ave.

Carlson, Stanley Allen, C.E., has recently changed his address to 1524 Hollywood Ave., Chicago.

Chun, Edwin Hing Tung, M.E., who is with the U. S. Engineer Office at St. Paul, Minn., recently changed his address to 203 N. Grotto St., St. Paul, Minn.

Elman, Julius, Arch., who is an Engineer in the Structural Department of the Universal Oil Products Co., recently changed his address to 5606 Fulton St., Chicago.

Fagen, Morton, E.E., who is an Engineer with the General Electric X-Ray Corp., recently changed his home address to 5732 Maryland Ave., Chicago.

Guyot, William S., Ch.E., who is an assistant in the Testing Department of the Public Service Co. of Northern Illinois, recently changed his home address to 2031 S. 12th Ave., Maywood, Ill.

Hamlin, Harry H., E.E., who is with the International Business Machine Corp., recently changed his home address to 1723 N. Long Ave., Chicago.

Lind, Stanley M., Ch.E., who is a salesman for Harry Holland & Son, Inc., recently moved to 919 E. 82nd St., Chicago.

Long, Russell E., Ch.E., who is Chief Engineer for C. H. Hollup Corp., has moved to 4717 Lawn Ave., Western Springs, Ill.

Nordell, Walter Emanuel, F.P.E., who is Special Agent in Iowa for Crum & Forster, recently changed his address to 1624 37th St., W., Des Moines, Iowa.

Seiferth, George Robert, M.E., recently moved to 6441 N. Richmond, Chicago.

Westerberg, Torgny J., C.E., who is a Bridge Inspector for the Chicago, Milwaukee & St. Paul R. R., recently moved to 830 Dee Road, Park Ridge.

Willow, Anthony Emil, C.E., recently changed his address to 2430 N. Harding Ave., Chicago.

1933

Baumann, Wilbur Emmett, C.E., has changed his address from Ada, Okla., to 1336 Fayette Ave., Springfield, Ill.

Giovan, Nick C., C.E., who is Vice-President and General Manager of the Drexel Ice Cream Co., has recently changed his home address to 5043 Drexel Ave., Chicago.

Hallen, George K., E.E., who is a Time Study Engineer with Belden Mfg. Co., recently changed his home address to 5422 Washington Blvd., Chicago.

Hess, Robert A., M.E., who is an Engineer with the Hess Warming & Ventilating Co., has changed his address to 1514 E. 68th St., Chicago.

Johannisson, Sven, Ch.E., who is with the Armstrong Paint & Varnish Co., has changed his address to 5350 N. Spaulding, Chicago.

Mahone, Albert L., E.E., who is a Metal Sales Engineer for Eagle-Picher Sales Co., recently changed his address to 6510½ Glenwood Ave., Chicago.

McLane, John Raymond, Arch., has changed his address to 123 E. First St., Dixon, Ill.

Sademan, Elmer E., F.P.E., who is an engineer for the National Fire Insurance Co., has changed his address to 325 Merton Rd., Detroit, Mich.

Siegal, Irving, Arch., recently moved to 2858 N. Kenneth Ave., Chicago.

1934

Adreani, Arthur John, Arch., who is a Fire Prevention Engineer with the Associated Agencies, Inc., is now residing at 4848 Wellington St., Chicago.

Anders, Archie, M.E., who is connected with the Oak Manufacturing Co., recently changed his address to 4420 North St. Louis Ave., Chicago.

Clarkson, Clarence W., E.E., who is in the Engineering Department of Belson Mfg. Co., recently changed his address to 4350 N. Bell, Chicago.

Ellis, Raymond Laurence, F.P.E., recently changed his address to 1240A Moorland Drive, St. Louis, Mo.

Gibson, Bernard Norman, Arch., who is a salesman and draftsman with W. P. Fuller & Co., in Los Angeles, has changed his home address to 2452 Riverside Drive, Los Angeles.

Gilmore, William R., E.E., who is an Engineer with the Bowman Dairy Co., is now living at 706 Junior Terrace, Chicago.

Kolve, Irving Arne, M.E., has recently moved to 1507 N. Mayhill, Chicago.

Nelson, Robert Plantin, M.E., who is a Sales Engineer for Pyott Foundry & Machine Co., recently changed his address to 939 Argyle St., Chicago.

1935

Ahern, John Joseph, F.P.E., is now living in Dearborn, Mich., at 7757 Miller Road. Ahern lately was transferred to Detroit by the Insurance Co. of North America.

Cox, Harold Edward, M.E., who is a Sales Engineer with the H. H. Robertson Company in Cincinnati, Ohio, recently changed his address to 3912 O'Leary Ave., Cincinnati, Ohio.

Dalton, Robert Francis, Ch.E., recently changed his home address to 5905 Ohio St., Chicago.

DeBoo, Joseph Henry, M.E., is now a calculating and design engineer for the International Harvester Co., at the Tractor Works in Chicago.

Goldberg, Charles K., M.E., has recently changed his address to 6609 S. St. Louis Ave., Chicago.

Herzog, William T., Arch., recently changed his address to 4043 N. Harding Ave., Chicago.

Highman, Arthur, Ch.E., who is with the Navy Department, in the Bureau of Construction and Repair, Washington, D. C., now resides at 1435 Perry Place, N.W., Washington, D. C.

Jones, Thomas Francis, M.E., has recently entered the employment of the American Air Lines. He is assigned to the Engineering Offices at the New York Municipal Air Port on Long Island.

Kulpak, Alexander, M.E., who is doing engineering work for the Rock-Ola Mfg. Co., has proved his versatility by singing operatic solos in "Boris Goudinov" and "Tannhauser" at the Chicago Civic Theater.

Messinger, Bernard L., M.E., who is Designing Engineer with Peerless of America, has changed his address to 628 Sheridan Rd., Chicago.

Schmidt, Edward Walter, Ch.E., who is an engineer with the Link Belt Co., has changed his address to 6816 Perry, Chicago.

Schnackel, Charles Arthur, Ch.E., who is with the Western Electric Co., recently moved to 3212 Scoville Ave., Berwyn, Ill.

Sims, Stanley, M.E., who is an Engineer with the Barrett Company, recently changed his address to 2554 W. 70th St., Chicago.

[Editor's Note: The following information with reference to the Mechanicals of the Class of 1935 comes to us from Ray Maci, who has done an excellent job in recording the activities of his department.]

The Mechanicals of the Class of '35 held their annual meeting at the Recreation Rooms of the Stevens Hotel on December 8, 1939. Leroy Beckman was elected to succeed T. Francis Jones as president of the group. Following a banquet and business session, the members spent the remainder of the evening relating experiences and enjoying bowling and billiards.

During the past year four more M.E.'s left the bachelor ranks bringing the average number of single men below the 50 percent mark. Ervin Mezera and Miss Mary Kostelny were married September 9th, and Charles Goldberg and Miss Fannie Weisman were united in wedlock June 25th. Harry Drell and Miss Marcia Shinitzky were married on December 24th. The latest news from John Birdsong of Schenectady, N. Y., tells us he has married the former Frances Wheeler of Westfield, N. J., during the holiday season also. Congratulations and best wishes to the newlyweds.

Mr. and Mrs. Leroy Beckman announce the arrival of a baby girl on May 8th, and Mr. and Mrs. Fred Meyer have become the proud parents of a baby boy born September 20th. Congratulations.

1936

Balai, Nicholas, Ch.E., is now connected with the McNeily Oil Company of LaGrange, Ill. His home address is 604 E. Main St., Fairfield, Ill.

Curran, John Martin, C.E., who is an Assistant Topographer with the Postal Service, recently changed his home address to 5717 Hermitage Ave., Chicago.

Domerowski, Walter M., C.E., who is a junior testing engineer with the Illinois Division of Highways, recently changed his address to 309 W. Edwards St., Springfield, Ill.

Gallagher, Francis Hugh Edward, M.E., who is with the U. S. Steel Company, has changed his address to 2854 N. Mango, Chicago.

Hoffert, Franklin David, Ch.E., is now employed by the M. W. Kellogg Co., Jersey City, N. J.

Kercher, Roy S., E.S., who is an Engineer with Cutler Hammer, Inc., has changed his address to 2639A N. 55th St., Milwaukee, Wis.

Kirsch, Earl James, E.E., who is now an Electrical Engineer for the Standard Transformer Co., Warren, Ohio, has recently moved to 1030 Trumbull Ave., Warren, Ohio.

LaPedus, William Edward, M.E., is now with the Adams Machinery Co. in Chicago.

Larson, John Owen, C.E., who is with Procter & Gamble, has changed his address to 48 Andover Road, Green Hills, Cincinnati, Ohio.

NEAL, DONALD JOHN, F.P.E., recently moved to 633 Garfield St., Oak Park.

NELSON, VINCENT GOTTFRED, Ch.E., recently changed his address to 1927 N. Washtenaw Ave., Chicago.

NYLEN, SVEN THURE, JR., C.E., who is with the U. S. Gypsum Co., recently changed his address to Box 683, Lyons, Ill.

SCHMIDT, ROBERT WALTER, Ch.E., who is with the Republic Steel Co., recently moved to 7808 Indiana Ave., Chicago.

SKJORDAHL, ARTHUR J., M.E., who is an Engineer for the Teletype Corp., recently changed his address to 4410 Altgeld St., Chicago.

TIMBERLAKE, DAVID CHARLES, F.P.E., who is an Engineer for the Kentucky Actuarial Bureau, recently changed his address to 1414 Highland Ave., Louisville, Ky.

1937

BOEHME, ROBERT ALEXANDER, M.E., who is connected with the Danly Machine Specialties, Inc., is now living at 2628 N. Hoyne Ave., Chicago.

LOWAY, ROBERT KENNING, M.E., has changed his address to 520 Perry Ave., Port Clinton, Ohio.

MCGRATH, JOSEPH KENNETH, C.E., has moved to 7631 Union Ave., Chicago.

NEARING, WILLARD C., M.E., who is with The Chicago Machinery Laboratory Co., has moved to 1241 North Shore Ave., Chicago.

WESTERMAN, FRANCIS GEORGE, F.P.E., who is Field Engineer for the Western Factory Ins. Assn., recently changed his address to 8011 Eberhart Ave., Chicago.

TARADASH, SAMUEL, C.E., who is an Engineer for the International Boundary Commission, recently moved to 14533 Wentworth Ave., Chicago.

WINEL, PETER JR., M.E., who is a Sales Engineer for the Central Screw Co., recently changed his address to 1740 Henderson St., Chicago.

WOBIG, ARTHUR HYDE, Arch., who is Promotional Manager for Sears Roebuck & Co., recently changed his address to 2304 National Ave., Milwaukee, Wis.

1938

CHELGREN, WILLIAM JUDD, M.E., who is connected with the Remington Arms Co. in Bridgeport, Conn., recently changed his address to 316 Stratfield Road, Bridgeport, Conn.

FAUST, RALPH MATHIAS, M.E., recently changed his home address to 6522 Bosworth, Chicago.

SCHRAIEBER, ALBERT NATHAN, M.E., under date of December 9, 1939, wrote to the placement office, from Bremerton, Washington as follows:

Dear Mr. Schommer:

After my graduation I worked for Kalmin Steiner, Ch.E., '24, as his assistant at the Midwest Heat Service Company, Mr. Steiner at that time was Chief Engineer for the company. The work consisted of the design, supervision of installation and servicing of industrial and domestic oil burning systems.

In February of this year I accepted an appointment as a Junior Mechanical Engineer at the Puget Sound Navy Yard where I am now employed. I have been assigned to the Ventilation Planning Department, and am doing design in ventilation equipment and systems for naval vessels. Dave Rodkin, M.E., '38, my partner at Armour, is also here doing the same work, and in fact we have our desks adjacent. I have met another Armour man in the Navy Yard; he is E. C. Dobbie, E.E., '11, who is in the Hull Planning Department.

When I was in Chicago this fall I was married to Miss Jeanette Barrett on September 24, a graduate of the U. of C. She is the sister of Robert Barrett, M.E., '41.

The change of Armour's name to the Illinois Institute of Technology came as a surprise, but the more I have thought about it the better I like the idea. I suppose it will take a while for the new name to be publicized, but I am sure that once it is, the good-will that has been built up for the old name will be transferred to the new.

I hope you find the coming holiday season very pleasant, and I hope to be able to drop in to see you when I am in Chicago again.

Sincerely yours,
A. N. SCHRAIEBER.

1939

BUCKMAN, WILLIAM B., Ch.E., was reported to have been connected with the Jefferson Electric Co. Mr. Buckman informs us that he is employed in the Process Control Department of the Carnegie Illinois Steel Company.

CARLSON, EARNEST C., C.E., who is with the Page Engineering Company, was awarded a special prize in the Timber Bridge Design Contest conducted by the National Lumber Manufacturers Association.

CHADERTON, JULIAN C., C.E., recently changed his home address to 4702 N. Winchester Ave., Chicago.

GAFNEY, JEROME, Ch.E., a former member of the class of 1939, passed away on December 19, 1939.

REH, CARL W., C. E., who is with the Ramtite Company, recently was awarded a special student prize in the Timber Bridge Design contest sponsored by the National Lumber Manufacturers Association.

ENGINEERING IN AIR TRANSPORTATION

(From page 9)

conducted and frequently weaknesses are discovered and corrected with the result that better products are eventually installed in the fleet.

Such testing requires elaborate equipment in some cases. For instance, United Air Lines maintains one twin-engine airplane for the sole purpose of conducting tests and research under actual operating conditions. Another interesting piece of testing equipment is the altitude chamber in which equipment can be tested at the equivalent of any altitude desired up to approximately 65,000 feet above sea level. The altitude chamber has been used extensively in the development of oxygen equipment and of various radio units which are affected by altitude.

In the early days of air transportation, airplanes were purchased pretty much "off the shelf." The operators had limited experience in this new mode of transportation and were not certain what demands it made on flying equipment. Furthermore, the requirements of most operators were small and they were not in a position to have special airplanes built for them. However, as air transportation has grown, this situation has changed. For example, detailed specifications for the Douglas DC-4 were prepared by engineers of five major air lines before any design work was started by the manufacturer. Engineering representatives of these air lines followed the design, construction and testing of the experimental airplane in minute details. As a result, the thirty-six production models of this airplane now under construction will be built to the exact requirements of the air lines.

COMMUNICATIONS ENGINEERING DEPARTMENT

In any transportation system, a rapid and accurate network of communication is essential. Because of the speed of air transportation and because of its dependence on immediate weather information, the existence of an elaborate communications system is absolutely necessary. Continuous radio communications are maintained from airplane to ground, ground to airplane, and point to point on the ground. In addition, leased telegraph wires and the long-distance telephone are used extensively.

The development of aircraft radio has been continuous and rapid. The original development work of the two-way airplane-ground voice radio system was carried out almost entirely by the communications engineering departments of the pioneer air lines. Since the early days of air transportation, some of the air lines have maintained well equipped radio laboratories where many of the radio units now in use were designed and developed. This applies not only to the voice transmitters and receivers but also to the radio range receivers and radio direction finders now standard equipment on most transport airplanes.

In the last three or four years two very important radio aids have been brought near perfection by the joint efforts of the air lines' communications engineers and certain radio manufacturers. They are the radio instrument landing system and the terrain clearance indicator. The first of these allows an airplane to be landed accurately on the runway of an airport under conditions where the pilot can see nothing outside of the cockpit. When this system is put into general use in the next year or two it will make the operation of transport airplanes largely independent of weather conditions. The second development, the terrain clearance indicator, is in reality a radio altimeter which records accurately the height of the airplane above any obstruction on the ground.

The communications engineering department, like the airplane engineering department, is constantly faced with the problem of making equipment work efficiently and economically. Seldom does new radio equipment work perfectly and consequently it must be redesigned and reworked as tests and service experience indicate this to be necessary.

The communications engineering department is also responsible for determining what ground communications to use in order that the most efficient and economical service shall be obtained. This requires a continuous study not only of the telegraph and telephone services available but also a complete familiarity with the ever-changing requirements of the air-transport company.

Because the communications engineering department is made up of electrical and radio engineers, it is also responsible for the development of electrical equipment, other than radio, on the airplanes. In recent years much research has been conducted toward the development of more efficient and lighter airplane electrical systems.

BUILDING ENGINEERING DEPARTMENT

Like any other business, an air-transport company requires a plant on the ground. Due to the nature of air transportation, its ground plant must be far flung. Furthermore, specialized buildings are required and the rapid growth of business and flying equipment has necessitated frequent changes of the ground plant. These conditions have given rise to the development of building-engineering departments by the air transportation companies. These departments are made up of men with building-engineering, architectural or building-contracting experience. They design revisions to existing buildings and determine how the requirements of the company can best be met in new buildings.

* * *

In these brief notes an effort has been made to show what part engineering and engineers play in the complex business of air transportation. It is a young business and constantly changing, with the result that the air line engineer is constantly "on his toes" keeping up with the parade. Truly the best motto for the air line engineering departments is "Never a dull moment."

TRAFFIC CONTROL

(From page 15)

controller to insure their keeping in step on the designed cycle.

The flexible progressive system uses a common cycle length throughout the system but the split of this cycle into color phases at the various intersections is made in accordance with a timing schedule so as to permit continuous undelayed progression of a group of vehicles along the street at a planned rate of speed. The phases of the cycle at any one intersection are adjusted to the traffic needs at that particular point.

The difference in time between the appearance of the same color indication at the various intersections, as compared with some reference time, is called the offset. The modern flexible system permits the use of more than one offset during the day so that the signals may be made to facilitate unidirectional flows of traffic. For example, a north and south street may have its signals offset to favor city-bound southward traffic during the morning rush period, have a second offset for normal operation and a third offset to favor northward home-bound traffic in the evening. A master controller is a necessity in the flexible system.

Pedestrian-actuated signals may also be used as a part of a traffic-actuated installation and in some cases have been used with other types where pedestrian traffic is exceptional and vehicle volume relatively light, as frequently occurs near school buildings. Timing cycles are always designed with the pedestrian as one of the factors. One of the functions of the amber color between the green and red is to allow the pedestrian caught off the curb to reach the sidewalk before opposing traffic starts.

The ultimate in traffic signal systems is the progressive type with the addition of signal faces to control turning movements and pedestrian crossings. The signal system of downtown Michigan Boulevard in Chicago is a famous example of complete traffic control.

Placement of the signal standards, the design of the signal faces, the position of the colors on any side of the signal head, the exact color of the lenses and many minor points of design are standardized but have not yet received uniform adoption by municipalities. The standard color position is red at the top, amber next below red, and green below the amber, with other indicators such as turn or walk lamps below the green. Uniformity of this placement builds habit in the driver and likewise aids color-

blind drivers who watch the position of the lighted lens.

All of these various signal types have their definite warrants for usage and an intersection should never be signalized unless a traffic study has shown that the standard requirements for a signal of some type exist. In general 1,000 vehicles per hour for eight hours is the principal requirement for a signal. Combinations of conditions are also recognized as warranting a signal. The general conditions warranting the use of fixed time signals are as follows: (1) minimum vehicular volume; (2) heavy left turn volume; (3) minimum pedestrian volume; (4) coordination of movement; (5) through highway; (6) accident hazard (only with heavy volume); and (7) a combination of factors. The exact volumes for each case are given in the Manual. The survey to determine the warrant should in all cases be made by a competent engineer with special traffic training. The traffic-actuated signal likewise has its standard warrants for application.

There has been more abuse of the principles of traffic signal placement than any of other element of traffic control. The average citizen after hearing the squeal of brakes at an intersection near his home usually rushes to his alderman and sets up a clamor for signals.

Smaller communities seem to feel they must have signals as an element of civic pride. In many cases signalization has produced a higher accident rate than existed before the installation. This of course would only occur if signals had been placed without a careful study of the intersection by a traffic engineer. The writer wishes to stress the point here that there is no uniform solution for traffic hazards of any one type but that each must be given individual study before any remedial measures are applied.

Pavement Markings.

Pavement markings are not generally recognized as traffic-control devices but they are invaluable and assume major importance in some locations. The center stripe to divide opposing streams of traffic from each other or to guide a stream around an obstruction is a necessary and useful device. The trend at present is to add a distinctive type of center marking to indicate when passing is dangerous. The double stripe is quite common, an additional stripe on the driver's side of the center line indicating that it is unsafe to cross the lines. Wavy or snake-like center lines have been tried as indicators of an approached hazard but maintenance cost as well as the effect upon the driver has indicated its unsuitability. Pavement markings are also used to delineate parking zones, loading zones, safety zones, pedestrian crosswalks and distinct lanes of broad highways. Lettering painted upon the pavement has had considerable usage but is not very common at present except for railroad-crossing warnings.

Islands.

An island is a raised area for the purpose of excluding vehicular traffic either to provide segregation of vehicles and pedestrians or to control conflicting traffic streams. Safety zones, street-car loading-platforms and pedestrian refuge-zones are examples of island usage to segregate the two principal elements of traffic. The traffic island for the control of vehicular movement may be one of three types: (1) divisional; (2) channelizing; and (3) rotary.

The divisional island is used to separate opposing parallel streams of traffic or to segregate streams of varying speeds moving in the same direction. Center parkways have become quite common, but separating islands for speed lanes are not in common use. Chicago is to have an installation of elevating divisional islands to facilitate unidirectional major flow along the north shore. These islands will provide the separation between opposing streams of traffic according to the number of lanes required in each direction at any time of the day. While expensive, they will undoubtedly be effective, and certainly will be more sightly than wooden horses set on the pavement.

Channelizing islands are of irregular shape, generally triangular, and are usually placed in areas not used or needed by normal traffic flow. Their function is to limit the possible paths of a vehicle through an area to those which provide the best movement of the traffic streams.

They make the correct driving procedure the easiest for the driver to follow. By them turning movements may be separated from the main stream without disturbing linear flow. The psychological advantage of the channelizing island lies in the fact that it limits driver decisions to one at a time. In treating a large intersection-area it is quite common among traffic engineers to determine the most-used pathways by observing tire tracks in the snow or in flour spread over the area. Channelizing islands are then used to fill the areas showing few tracks. This method gives the correct solution since in any situation the action of the majority of drivers is usually the correct practice. In new construction, placement of channelizing islands is determined upon

the basis of allowing each particular traffic stream to accomplish its desire with the smoothest flow and the least interference with other streams.

The rotary-traffic island or traffic circle is placed at the center of an intersection area in order to raise the intersection capacity as close as possible to the capacity of the intersecting highways. Traffic flows to the right around such an island, weaving into other traffic until it reaches the desired exit street. No vehicles can meet at right angles and no left turns can be made in a rotary separator. Instead of complete stoppage of intersecting streams we achieve a merging at slightly reduced speeds and a separation into individual streams again, with very small delay to the vehicles. Rotary islands, properly designed with triangular channelizing islands at each street entrance, will safely handle large volumes of traffic at a fraction of the cost of a grade-separation structure. In a good many cases grade separations have been built where rotary islands would easily have handled the traffic. For many intersections the grade separation is of course the only solution, provided the traffic flow is not so complicated that the structure becomes a maze to the drivers. The engineer must be careful not to overestimate the ability of the average driver to solve a puzzle while driving at the usual highway speeds.

Parking

The problem of vehicle parking is one of the chief worries of city traffic engineers. From a legal point of view the primary purpose of a street is the movement of traffic. Courts have held that streets may be used for other secondary purposes only when such use does not interfere with the primary function of the street. Retail merchants frequently have the opinion that the prohibition of parking will ruin business, but business surveys, after parking restriction is in force, almost invariably show an increase in business volume. No definite solution to the parking problem has been found and it continues to be a prime source of discussion among traffic engineers and citizens as well. Parking meters at the curb, operated by coin for a small fee per hour have proved successful in some cities. Their success is due to the fact that they allow more efficient use of curb space through the shortening of the parked time per car. In all parking problems it is the long-term parker who causes the principal difficulty through reducing capacity. Of course he must park somewhere and some persons have suggested that municipal parking lots should be provided near every business district. The long-term parker of course does not cause any interference with traffic except through occupying one lane at the curb. Cars moving in and out of parking spaces interfere directly with at least one moving traffic stream. Opinion on the position of parking is well crystallized in favor of parking parallel to the curb as there is less street-width used in the total parking operation. Car-berth capacity in parallel parking is of course less than in angle parking. As in the other phases of traffic control, no changes in parking regulations should ever be made without a sound analysis of conditions as disclosed by a parking survey.

The subject of traffic engineering surveys, which has been indicated as a necessary part of the solution of any traffic problem, is in itself a broad and complex field. It is a serious mistake for anyone to assume that traffic surveys and traffic-control problems can be handled by any engineer, for they require a high degree of specialized knowledge and skill. There are scarcely 150 men in the United States who could be classified as competent traffic engineers.

The writer has confined this paper principally to the standard traffic control devices and has attempted to indicate the nature of the problems encountered as well as to show the extraordinary type of engineering knowledge and skill necessary in a successful traffic engineer.

RESEARCH IN MATHEMATICS

(From page 19)

this will ultimately yield much valuable information concerning such classical problems as the solution of algebraic equations.

Geometry, long ago having abandoned such restrictive problems as the construction of figures by ruler and compass, has reached a point where almost any collection of things and of rules of handling these things is thought of as forming a space. The power of modern geometry lies in the fact that mathematical entities such as numbers and curves can be thought of as points in various kinds of spaces so that geometrical methods yield relations between these things that could not be obtained otherwise. An examination of the numerous geometrical papers constantly appearing in the research journals reveals that a figure (drawing) is as rare as a needle in a haystack, for the modern symbolic technique of treating geometrical questions and the development of postulational methods makes figures almost always unnecessary.

The major present development in geometry is topology, of which the most famous unsolved but very special problem is the four-color problem, namely, that any map can be colored with four colors in such a way that no two adjacent countries have the same color. That this can be done with five colors has been proved, and that there are maps that require four colors has also been demonstrated. In 1938 Philip Franklin extended the existing proof for 30 countries to 31 countries. The general proof of the four-color theorem, if true, will probably come as a product of the further development of topology, for which already a number of applications to such subjects as electrical networks and the motion of material particles have been found. The point of view of topology has been applied with much success to algebra and analysis. Among the many problems in analysis in which there has been considerable interest is the problem of Plateau, namely, that of finding a surface of least area that can be passed through an arbitrarily given closed curve. In the last ten years distinct solutions for this problem have been obtained by Jesse Douglass and Tibor Rado, but the subject is by no means exhausted.

The field of analysis has attracted more researchers than any other of the branches of mathematics. Much of the recent progress in this field is due to the development of spaces of infinitely many dimensions initiated by David Hilbert, considered the greatest living mathematician of our time.

In mathematical logic there is considerable interest in the application of the methods of modern algebra, due largely to the work of George Boole (1854), and Marshall Harvey Stone (1936).

From the form of mathematical proofs as given in the literature a novice in the subject may conclude that the mind of a mathematician operates much like a slot machine. That with a small initial impulse the mathematician lays down a set of assumptions, and automatically from step A his mind yields step B, from step B, step C, and so on in a continuous stream until the machine stops suddenly with a finished theorem completely proved, and the mathematician realizes that he has hit the jackpot. Actually, by some manner or the other which cannot always be explained the mathematician gets a hunch that something is true, and then tries to find a proof for it. Often he makes dozens of unsuccessful attempts before finding a correct demonstration for his assertion, if he is so fortunate as to find one at all. In publishing his results these unsuccessful attempts are not even mentioned.

Although the results of mathematical investigations are published in the form of articles, called "papers," in research journals, the mathematician does not set out for himself the task of writing a paper, but rather he attempts to solve some problem needed to fill in the structure of his field. After the development has attained a certain completeness, and important discoveries have been made, the work is turned over to the public in the form of a mathematical paper. Such papers are the by-products of research, necessary to preserve the discoveries of the mathematician for the benefit of contemporary workers and future generations. Although the greatest mathematicians of history have been prolific in ideas and in the publication of their ideas, it is not to be conceived that the mere production of numerous mathematical papers is a measure of greatness or the main goal of the researcher. A hundred mathematical papers of low quality published in second-rate journals are hardly to be compared with one first-class paper in a good journal. So much aversion did the late Eliakim Hastings Moore, in many ways the leading American mathematician of his time, feel about publications that he died leaving unprinted so much

worth-while material that one of his former students has spent the last ten years whipping these results into shape for publication, and the task is by no means completed.

There are in America five research journals of mathematics, in quality unexcelled by any others in the world. Of these the American Journal of Mathematics, the Duke Mathematical Journal, and the Annals of Mathematics appear quarterly, while the Transactions of the American Mathematical Society and the research issues of the Bulletin of this society appear six times a year. Each of these journals except the bulletin contains 800-1000 pages a year, while the Bulletin publishes somewhat less. From a glance at these journals the reader is impressed by the absence of advertising, and pictures of any sort. These journals maintain a uniform standard of excellence, with the Annals of Mathematics and the Transactions holding the lead with the policy of favoring longer papers.

The research journals demand that the papers submitted to them for publication contain new results of significance, and that they be written in a clear but highly abbreviated style. Since the research mathematical journals are available in all of the major universities of the world, and articles containing new mathematical contributions published anywhere are reviewed in an abstract journal, it would be considered highly unethical to attempt to publish the same material in two journals, no matter how distantly separated are the places of publication. Thus, research papers appearing in one journal are not translated from one language to another, the translation appearing in another research journal. The insistance on new material and great brevity of style is necessitated by the relatively high cost ($8-$10 per page) of printing mathematical articles, and the constant pressure of material for publication. This pressure imposes a lapse of at least eight to twelve months between the receipt of a paper by a journal and the date of its appearance. A recent survey shows that fifty per cent of the published mathematical research in America is the product of five per cent of the doctors of philosophy in this field.

A mathematical paper is at best an outline of a process of reasoning, the reader being left to supply the intermediate steps as he finds it necessary. Throughout this article the word "theory" has been used in the usual mathematical sense of development, without meaning to imply by this term that the mathematician is uncertain as to the validity of his work or his assumptions. As mathematics there is no question as to the truth of the theory of relativity, whereas its being a perfect fit to the material universe is not claimed. Since each result in a mathematical paper can be checked directly by the referee or referees who decide as to whether or not the work merits publication, the scientific standards of the mathematical journals is exceedingly high.

Of the two mathematical organizations in America, the American Mathematical Society encourages research and aids in the support of the various American research journals, while the American Mathematical Association caters to exposition, publishing its own journal, the American Mathematical Monthly, which favors articles which the mathematician considers to be of the more popular variety.

Some idea of the growth of mathematics in the United States can be gathered from the increase in membership of the American Mathematical Society from 260 in 1895 to 2,200 in 1938, and the increase in the cost of publications from $556 in 1895 to $30,500 in 1938. Due in part to the invigorating influx of several of Europe's most brilliant scientists, mathematical activity in the United States and Canada has had a very rapid rate of growth, while in many other countries it has been definitely on the decline. Thus the eyes of Europe, the mother of learning, are turning to the west.

Here at Armour Institute active research is being carried out in Algbera, geometry, analysis, and applied mathematics. Much progress has been made in the problem of Plateau; in the study of spaces of infinitely many dimensions, which spaces have application to the determination of the frequencies of lines in the spectrum bands of elements; and in the general theory of functions and the conformal mapping of spaces—fields applied so successfully to such things as aerodynamics. The theory of polynomials with application to the solution of equations and the structure of curves and surfaces in space, as well as the study of properties of matrices, used in civil and electrical engineering, is proceeding with success.

There are also investigations in applied mathematics on the properties of elastic and plastic bodies, the flow of fluids, and the motion of particles, with application to such topics as the pivoting of teeth, the shape of propellers and wings of aeroplanes, and the transmission of heat. These activities give Armour Institute one of the leading places in pure and applied mathematics among the engineering colleges.

MODERN PIONEER-

(From page 28)

part responsible for the efficiency of communications and the wide-spread use of Teletype and telegraphic devices throughout the United States. The general use of the machines based upon Mr. Krum's inventions contributed to greatly increasing the speed and volume of telegraphic communication, resulting in better and faster service to the public by air, land, and sea."

CARL PFANSTIEHL, former student, A. I. T., Vice President and Director of Research, Pfanstiehl Chemical Company, Inc.

"Mr. Pfanstiehl organized, about thirty years ago, the Pfanstiehl Electrical Laboratory, now known as the Fansteel Metallurgical Corporation. The latter company has made wide and valuable application of Mr. Pfanstiehl's patents and development work in the field of the rarer metals such as tungsten, molybdenum, and especially of tantalum and columbium. He also originated a new method for the manufacture of automobile spark coils. It is certain that these inventions and their development have had real economic value, including social advance by way of employment in new fields and lower cost of essential articles."

MIDWEST POWER CONFERENCE

(From page 31)

(b) The Santee-Cooper Project. L. F. Harza, Harza Engineering Co., Chicago.

(c) The Hydrological Factors in the Design of a Dam. James S. Bowman, Tennessee Valley Authority, Knoxville, Tenn.

(d) Discussion.

12:00 Noon. Joint Luncheon with A. I. E. E.

Speaker: L. W. W. Morrow, Editorial Director, McGraw-Hill Publications, Chicago.

1:30 P. M. Bus leaves Palmer House for Inspection of Plant of the Electro-Motive Corp., Subsidiary of General Motors, LaGrange, Ill.

4:15 P. M. Bus returns to Palmer House.

8:00 P. M. Smoker.

Entertainment will include an illustrated story of the power features of the Snow Cruiser and its trip to Boston. Dr. Thos. C. Poulter of the Armour Research Foundation, who supervised the design of the Cruiser and went with it to the Antarctic Continent, is expected to be present at the smoker.

I'VE BEEN THINKING AGAIN

(From page 32)

Gradually, I think, we are doing things better in this respect than when I was a student. Summer work in industry is often urged upon students, as a means of learning many things the college cannot teach. Inspection trips to industrial plants are now quite common, and should, it seems to me, be organized as a definite part of the curriculum. Reports should be required from all students, and credits should be given for the work. Finally, there is the cooperative plan which seems to provide a splendid balance between life in college and life in industry. Whatever the plan, we teachers should remember that beyond Commencement Day a crisis lurks. It will be met with courage and high endeavor if we have done our full duty.

Well, I have been thinking quite a while tonight, and the winter sky has changed a bit. Venus, elusive as feminine charm, has given her pursuers the slip and disappeared beneath the horizon. The others will soon be gone but they will all be back tomorrow night. It might be well to keep them in mind, for they are worth more than a glance.

THE BOOK SHELF

(From page 34)

"Christmas holiday"—with the understanding that he might turn it into a kind of Roman holiday if he chooses. He *does* choose; but at the very outset of his adventurings he meets a young woman who tells him of a life so utterly different from his, that he expends his holiday in, one might say, charity; and he returns home an altered man. Now, a great writer might have knocked you out of the ring with that; but it *is* banal, isn't it? Mr. Somerset Maugham seems to have thought so. As a consequence he introduces the irrelevant, he expands each incident as much as he possibly can; and although even there a first-string writer might have justified his florillations, Mr. Maugham becomes merely tedious. We get a host of quite unnecessary and unimportant information; we are told at length about the young man's family, their tastes and proficiencies in art and music, their concurrences and dissensions, their ambitions and occupations, with a good deal of their ancestry thrown in; we are told endlessly about an uninteresting young man named Simon, who figures slightly if at all in the plot; and when the young lady comes in—I suppose I should say young woman in this case—we are treated to her views on art and music (views I should be inclined to deprecate, although Mr. Maugham admires them), and so on, and so forth. Certainly some particles of all this are needed to make clear the nature of the change occurring in the young man, Charley Mason; but Maupassant, for one, would have got the whole thing in the twinkling of an eye.

If one can read as he runs, however, a certain pleasure can be got from the novel; a hasty reading would mercifully obscure a good deal that a more careful one would call into question. The characters are not ill-drawn, though they are not always intelligible; and, while no one has ever insisted that Mr. Maugham is a stylist, the style, despite certain ineptitudes, is not unpleasant.

STORE SEWAGE PLANT GAS UNDER PRESSURE

At many activated sludge sewage disposal plants, the gas that forms in the digesters is collected and utilized. Sometimes it is used to heat the plant buildings during cold weather or to keep the digesters at the proper temperature. The most common procedure, however, is to burn it as fuel in gas engines. The engines are either connected to blowers supplying the aeration chambers or to generators producing power for pumping sewage.

Sewage digesters do not produce gas at a uniform rate. In order to utilize gas at a sewage plant to maximum advantage, it is necessary to install a gas holder with sufficient capacity to supply gas to the burners or engines during the period of low production. Hortonspheres similar to the above installation at one of the Cleveland, Ohio sewage plants are often used. It is 57 ft. 6 in. in diameter and operates at 29.9 lbs. per sq. in. pressure.

Hortonspheres have several advantages for sewage plant service. They are relatively small and pleasing in appearance. There are no moving parts to require maintenance or water seals to heat. They are separate from the digester, eliminating unsightliness caused by the shell coming in contact with sewage.

THE SUMMER GRADUATE INSTITUTE

SUMMER GRADUATE COURSES

in

ADVANCED MECHANICS

CHEMICAL ENGINEERING AND CHEMISTRY

CIVIL AND SANITARY ENGINEERING

ELECTRICAL ENGINEERING AND PHYSICS

MECHANICAL ENGINEERING

INDUSTRIAL ENGINEERING

APPLIED MATHEMATICS

offered by graduate teachers from the staff of Armour Institute of Technology supplemented by the following list of

VISITING PROFESSORS

Ralph M. Barnes	Iowa State U.
John R. Baylis	City of Chicago
Barnett F. Dodge	Yale U.
William Everitt	Ohio State U.
C. C. Furnas	Yale U.
E. Hurwitz	Chicago Sanitary District
Lydik S. Jacobsen	Stanford U.
G. B. Karelitz	Columbia U.
Gabriel Kron	General Electric Co.
Chas. O. Mackey	Cornell U.
Floyd W. Mohlman	Chicago Sanitary District
J. C. Morrell	Universal Oil Products Co.
H. C. Taylor	Western Electric Co.
Stephen P. Timoshenko	Stanford U.
Frank C. Vilbrandt	Va. Polytechnic Institute
John I. Yellott	Stevens Institute

The following program of specialized graduate classes has been arranged to provide an opportunity for graduate work in the summer on the highest possible plane.

It is the policy of the Institute to invite scientists of great distinction to lecture each summer on modern developmens in engineering and science.

FOUR-WEEK TERMS

The first term will extend from June 17 to July 13; the second term from July 15 to August 10; the third term from August 12 to September 7.

INTENSIVE STUDY

The typical course listed will meet for the equivalent of two hours lecture daily (including Saturdays) for four weeks. The student will carry only one course for credit (4 semester hours) during each period of four weeks. Attention to the subject matter of one course only should make rapid development possible.

TUITION

The tuition fee will be 10 dollars per credit hour or 40 dollars per course of four weeks. Fees for half courses wiill be 25 dollars.

AUDITORS

A student regularly enrolled for credit in one course will be permitted to visit the lectures of a second course (without credit) upon the payment of an auditor's fee of ten dollars. Auditing more than one extra course will not be permitted.

DEGREES

The requirements for the M.S. degree as stated in the Graduate Bulletin involve 32 credit hours or 8 courses of 4 credit hours each. Research and the thesis may reduce the course requirement. The Doctor's degree is also available to qualified students working in those special fields emphasized in the graduate program of the Institute.

RESIDENCE

The normal residence requirement for the M.S. degree is 36 weeks. If the student has graduate residence at another recognized institution the Committee on Graduate Study will consider an application to reduce the residence requirement to not less than 24 weeks.

GRADUATE HOUSE

Room and board will be available for a limited number of students at about 40 dollars per month. Reservations will be accepted.

TIME OF MEETING

Most courses will meet in the mornings from 8-10 and from 10-12. Laboratories may be used in the afternoons.

COURSE WITHDRAWAL

The Institute reserves the right to withdraw a limited number of the courses listed where the registration is below five.

CATALOGUE

For added information and to obtain a copy of the summer graduate catalogue write L. E. Grinter, Dean, Graduate Division, Armour Institute of Technology, 3300 Federal St., Chicago, Ill. Give name, address and course interests.

SUMMER GRADUATE COURSES
ADVANCED MECHANICS

June 17 to July 13

40.01 Problems of Elastic Stability in Engineering. (4 credit hours)

Stephen P. Timoshenko. Professor of Theoretical and Applied Mechanics, Stanford University

Review of stable and unstable forms of elastic equilibrium as encountered in engineering; stability of struts; design of columns; stability of tubes under external pressure; stability of thin plates stressed in their middle plane; stability of cylindrical shells.

40.02 Theory of Vibrations. (4 credit hours)

Lloyd H. Donnell. Associate Professor of Mechanical Engineering, Armour Institute of Technology.

A course in fundamental theory, adapted to and illustrated by engineering applications. Balancing of parts with rotative or other cyclic motion; damping; free, forced and damped vibration of different types of systems of one or more degrees of freedom; critical speeds; wave transmission and standing waves; vibration instruments

and shop and field balancing method; approximate methods, etc.

July 15 to August 10

40.03 Structural and Mechanical Vibrations. (4 credit hours)
Lydik S. Jacobsen. Professor of Mechanical Engineering, Stanford University

Consideration of the dynamic loadings experienced by buildings and other structures due to earthquakes, windstorms, and machinery in motion. Earthquake vibrations of actual buildings are emphasized. Applications to mechanical engineering will be considered, and mechanical engineering problems given. An elementary knowledge of dynamics, of strength of materials, and of ordinary differential equations is assumed.

40.04 Dynamics of Fluid Flow. (4 credit hours)
Hans Reissner. Research Professor of Engineering, Armour Institute of Technology

Fundamental theorems of irrotational or potential flow of fluids and of rotational flow (laminar and turbulent in pipes and near boundaries). Due consideration will be given to compressibility and viscosity and to their engineering aspects. The phenomenon, the concept and the theories of turbulence with applications of flotation and silt transportation.

August 12 to September 7

40.05 Applications of Aerodynamics in Aviation. (4 credit hours)
Hans Reissner. Research Professor of Engineering, Armour Institute of Technology

The two-dimensional theory of the airfoil; the three-dimensional theory of the wing; problems of interference between the wings and the other aircraft parts; theory of propellers and its application to design.

40.06 Thin Plate and Shells. (2 credit hours)
Lloyd H. Donnell. Associate Professor of Mechanical Engineering, Armour Institute of Technology

A general theoretical study of the stretching and bending of plates and shells, with particular reference to engineering application. The course will include the following: simple two-dimensional elasticity theory; the practical limits of application of the various assumptions customarily made; approximate methods of solution; large deflection theory, etc.

CHEMICAL ENGINEERING AND CHEMISTRY

June 17 to July 13

40.07 Chemical Engineering Thermodynamics. (4 credit hours)
Barnett F. Dodge. Professor of Chemical Engineering and Chairman of the Chemical Engineering Department, Yale University

Review of fundamental definitions and concepts of thermodynamics. Development and interpretation of thermodynamic diagrams and tables of properties; compression and expansion of gases; fluid flow; heat transfer; chemical reaction equilibria; distillation and condensation and low temperature separation of gases. Emphasis on the solution of numerical problems.

40.08 General Catalysis. (4 credit hours)
Vasili I. Komarewsky. Research Professor of Chemistry, Armour Institute of Technology

Discussions of the main catalytic reactions in organic chemistry such as hydrogenation, dehydrogenation, dehydration, hydration, condensation, isomerization, polymerization, alkylation and oxidation, followed by the survey of different theories of catalysis; accompanied by laboratory work where students prepare catalysts and perform catalytic reactions at varying pressures.

July 15 to August 10

40.09 Interpretation of Chemical Engineering Data. (4 credit hours)
C. C. Furnas. Associate Professor of Chemical Engineering, Yale University.

Methods of making measurements; principles and applications of dimensional analysis; empirical formulas including least squares; theory of errors; setting up and solving differential equations of use in engineering; graphical methods of integration; differentiation and solving of important differential equations.

40.10 Industrial Catalysis. (2 credit hours)
J. C. Morrell. Associate Director of Research, Universal Oil Products Company, Chicago

Applicants of catalysis in the oil industry, particularly new methods of preparation of high anti-knock motor fuels. Properties of oil and chemical nature of different hydrocarbons; cracking and pyrolysis; catalytic cracking and aluminum chloride cracking; hydrogenation, dehydrogenation, and cyclization; thermo and catalytic polymerization, and water gas reaction (Fisher-Tropsch process)

August 12 to September 7

40.11 Advanced Chemical Engineering Plant Design. (4 credit hours)
Frank C. Vilbrandt. Professor of Chemical Engineering and Head of the Department of Chemical Engineering, Virginia Polytechnic Institute.

Bibliographic studies accompanying lectures on technical, economic and safety factors affecting selected projects. Presentation of reaction kinetics from the experimental point of view. Visualization of processes in terms of equipment, men and money. Final report with bibliography, market data, calculations, flow sheets, material balances, plan and elevation.

40.12 Designing Equipment for "Applications of Chemical Engineering." (2 credit hours)
Harry McCormack. Professor of Chemical Engineering and Director of the Department of Chemical Engineering, Armour Institute of Technology

Recent publication of a book with this title lends an added interest to the design and fabrication of laboratory equipment for experiments as given in this text. Such equipment design will be studied from the viewpoints of desired function, fabrication materials, relation of design to construction, operation, repair and cost.

CIVIL AND SANITARY ENGINEERING

June 17 to July 13

40.13 Water Treatment Processes (4 credit hours)
John R. Baylis. Physical Chemist in charge of Chicago's experimental Filtration Plant
E. Hurwitz, Principal Chemist, Chicago Sanitary District.

An advanced course covering the field of water treatment. The lectures will stress coagulation, softening, filtration and plant operation. The laboratory work will include bacteriological and chemical examination of water and plant control tests. A completely equipped pilot plant will be available for experimental work.

40.14. Significance of Mechanical Properties of Materials in Design (4 credit hours)
Joseph Marin. Associate Professor of Civil Engineering, Armour Institute of Technology

Mechanical properties of metal subjected to static, creep, fatigue, and impact loadings. Time yield in concrete. Discussion of tests and theories of failure for combined static, creep, and fatigue loadings. Selection of working stresses for various loading conditions. Design applications. Discussion of design codes and current research. Interpretation of mechanical tests.

July 15 to August 10

40.15 Automatic Design of Continuous Frames. (4 credit hours)
L. E. Grinter. Vice President and Dean of the Graduate Division, Armour Institute of Technology.

Modern methods of analysis of continuous beams and frames by processes of convergence presented and compared with the classical methods. Development of the automatic or direct design process with applications to continuous beams, frames, bents, and tier structures. Avoidance of influence lines and simple determinations where influence lines are required. Both steel and reinforced concrete structures will be discussed.

40.16 The Chemistry of Sewage Treatment (4 credit hours)
Floyd W. Mohlman. Adjunct Professor in Sanitary Chemistry, Armour Institute of Technololgy; Director of Laboratories, Chicago Sanitary District
E. Hurwitz, Principal Chemist, Chicago Sanitary District.

An advanced course in the chemistry of sewage treatment. The lectures emphasize the chemical, biological, and bacteriological reactions involved in sewage treatment processes. Considerable operating data will be presented. The laboratory work will include analyses of sewage, plant control tests, and research methods.

August 12 to September 7

40.17 Structural Mechanics (4 credit hours)
Joseph Marin. Associate Professor of Civil Engineering, Armour Institute of Technology

The analysis of stresses and design of structural members including bridge rollers, slabs, beams on elastic foundations, concrete tanks, and pile foundations, Buckling of beams, columns, and webs of girders. Combined stressed in shells and domes. The course is planned for students interested in structural engineering.

40.18 Advanced Sewage Treatment Plant Design. (4 credit hours)
Rolf Eliassen. Assistant Professor of Civil Engineering, Armour Institute of Technology

Lectures and computations on the design of sewage treatment plants. Treatment processes, basic design factors, hydraulic studies and mechanical equipment are emphasized. A series of practical design problems will be carried out covering several types of treatment. Plant estimates and economic analyses will be made.

ELECTRICAL ENGINEERING AND PHYSICS

June 17 to July 13

40.19 Matrix Properties and Application of Electric Circuits. (4 credit hours)
Myril B. Reed. Assistant Professor of Electrical Engineering, Armour Institute of Technology

The fundamental properties of matrices; three-phase power systems treated in terms of matrices. Current, voltage, and power

relations formulated in general terms and their important interrelations considered. Symmetrical components expressed in matrix form, with applications. Circuit transient problems with arbitrary initial conditions solved by matrices.

40.20 Communication Engineering.
(4 credit hours)
William L. Everitt. Professor of Electrical Engineering, The Ohio State University

Linear network theory applied to general transmission networks such as long lines, filters, equalizers and impedance transforming nets, the Fourier Integral, frequency, phase and amplitude modulation, vacuum tube circuits used as modulators, demodulators and amplifiers, electroacoustical coupling applied to microphones and loudspeakers

July 15 to August 10

40.21 Tensor Analysis of Electrical and Mechanical Engineering Problems.
(4 credit hours)
Gabriel Kron. Consulting Engineer, General Electric Company, Schenectady

Algebra of matrices. Transformation theory; interconnection of physical systems and other engineering transformations. Generalization postulates. Impedance tensors for steady state and for small oscillations. Invariant formulation of the equations of Lagrange and Maxwell; applications to mechanical networks, electrical machines at constant speed, small oscillations of mechanical control devices, motion of electrons in ultra-high frequency tubes.

40.22 Electrical Radiation and Radiating Systems for Radio Communication.
(4 credit hours)
William L. Everitt. Professor of Electrical Engineering, The Ohio State University

Physical principles and applications in the generation and transmission of electromagnetic waves used for radio communication. Fundamentals of vector analysis, Maxwell's Equations, Poynting's Theorem, the vector potential, the radiating doublet: the radiating characteristics of practical antennas including the design of directional antennas with their coupling systems; the propagation of radio waves in free space, in conducting and semi-conducting media, and in the Ionosphere.

August 12 to September 7

40.23 Physics of Electron Tubes
(4 credit hours)
Paul L. Copeland. Associate Professor of Physics, Armour Institute of Technology

Electron theory with particular reference to the phenomena occuring in standard types of vacuum and gas discharge tubes. Statistical laws in connection with problems in thermionic emission and the electrical properties of gases. Determination of fundamental electron constants; photoelectricity; critical potentials and collision processes in gases; arc and glow discharges; probe measurements; use of electrometers and electrometer tubes; thryations, grid-glow tubes and the ignitron.

MECHANICAL ENGINEERING

June 17 to July 13

40.24 Heat Conduction and Insulation.
(4 credit hours)
Max Jakob. Research Professor of Mechanical Engineering, Armour Institute of Technology

Steady state, sudden or periodical changes, with and without heat sources. Heat conductivity of gases, liquids, and solids. Insulating, building and refractory materials; influence of crystalline and amorphous states. Thermal and electrical conductivity of metals; temperature of engine walls and inside of electrical coils. Theory of surface combustion. Gas analysis by means of conductivity instead of chemical analysis. Designed for mechanical and chemical engineers.

40.25 Advanced Air Conditioning.
(4 credit hours)
Charles O. Mackey. Professor of Heat-Power Engineering, Cornell University

Thermodynamic properties for mixtures of air and water vapor; physical and physiological principles; sound and noise control; heating and humidification; spray and surface cooling; heat and moisture losses from buildings; heat and moisture gains, including solar heat; refrigeration in air conditioning; air distribution.

July 15 to August 10

40.26 Bearings and Lubrication.
(4 credit hours)
G. B. Kareiltz. Professor of Mechanical Engineering, Columbia University

Discussion of the mechanism of friction and oiliness of lubricants; viscosity of oils and measurement of coefficients to define it; hydrodynamic theory of lubrication, analysis of bearing performance; design of bearings with perfect and imperfect lubrication; bearing materials; mechanism of ball and roller bearings and their selection.

40.27 Heat Convection and Radiation.
(4 credit hours)
Max Jakob. Research Professor of Mechanical Engineering, Armour Institute of Technology

Free and forced convection; similarity and surface layer; heat transfer and pressure drop; viscosity; diffusion of visible vapors; optical refraction; time retarder. Pipes and tube banks; fins and baffles; hydrogen cooling; recuperators and regenerators; heat transfer in vaporization, condensation, and catalytic reaction. Laws of radiation and their thermodynamical and statistical background. Radiative heat insulation. Infra-Red photography of surfaces; ignition of coal powder; flame radiation in furnaces. Designed for mechanical and chemical engineers.

August 12 to September 7

40.28 Steam Power Plants.
(4 credit hours)
John I. Yellott. Assistant Professor of Mechanical Engineering, Stevens Institute of Technology; to be Director of the Department of Mechanical Engineering, Armour Institute of Technology

Theory and performance of steam power plant equipment. Source and accuracy of latest steam tables and charts. Recent developments in steam turbine practice. Heat transfer and circulating water requirements in surface condensers. Heat balances for modern extraction cycles. Auxiliary equipment. Combustion and steam generation. Circulation boilers; feed water treatment; pulverized fuel; automatic control and instrumentation.

40.29 Advanced Machine Design.
(2 credit hours)
Lloyd H. Donnell. Associate Professor of Mechanical Engineering, Armour Institute of Technology

Presentation of selected theories and techniques from the fields of elasticity, photoelasticity, vibration, critical speeds, dimensional analysis, and others directly associated with the modern design of machines and machine elements.

INDUSTRIAL ENGINEERING

June 17 to July 13

40.30 Manufacturing Standards.
(4 credit hours)
H. P. Dutton. Professor of Business Management and Chairman of the Social Science Department, Armour Institute of Technology

A study of the methods by which typical manufacturing problems are analyzed. Conduct of research in product design, method standardization and organization structure; conditions making for productivity in the analysis of industrial situations. Organization relationships; budgeting and financial policy; methods, systems, and production control. Lectures, collateral reading, field trips and discussions by guest speakers.

July 15 to August 10

40.31 Motion and Time Study.
(4 credit hours)
Ralph M. Barnes. Professor of Industrial Engineering, The State University of Iowa

Factors affecting the utilization of human effort; process and operation analysis, micromotion study; stop-watch time study. Motion economy and research applied to the development of the best methods of performing tasks. Emphasis on the procedure of selecting correct observed times, estimating differences in individual performance and developing general formulas for ranges of similar performances.

August 12 to September 7

40.32 Standards in Personnel Procedure.
(2 credit hours)
H. C. Taylor. Chief, Psychological Research Section, Western Electric Company

Analysis of job requirements from the standpoint of selection of individual adapted to their performance. Tests for specific abilities and attitudes; construction and evaluation of tests. Industrial experience and results in the use of tests in selection of employees. Employee records and systems of rating; relationship between the industrial environment and performance.

APPLIED MATHEMATICS

June 17 to July 13

40.33 Engineering Mathematics.
(4 credit hours)
Lester R. Ford. Professor of Mathematics and Chairman of the Department of Mathematics, Armour Institute of Technology

Review of certain more advanced topics from the calculus and an introduction to various mathematical methods which are used in the engineering field. Power series; partial differentiation; various integrals; Fourier series; determinants and matrices; differential equations; vector analysis; probability.

July 15 to August 10

40.34 Analytical Mechanics.
(4 credit hours)
Max Sadowsky. Instructor in Mathematics, Armour Institute of Technology

A course devoted to the study of mathematical theories in mechanics: analytical dynamics of particles and of rigid bodies; Lagrange's and Hamilton's equations; the theory of vibrations.

August 12 to September 7

40.35 Partial Differential Equations.
(4 credit hours)
Max Sadowsky. Instructor in Mathematics, Armour Institute of Technology

Theory of partial differential equations of the first order and the types of linear equations of the second order which are of wide use in the engineering applications.

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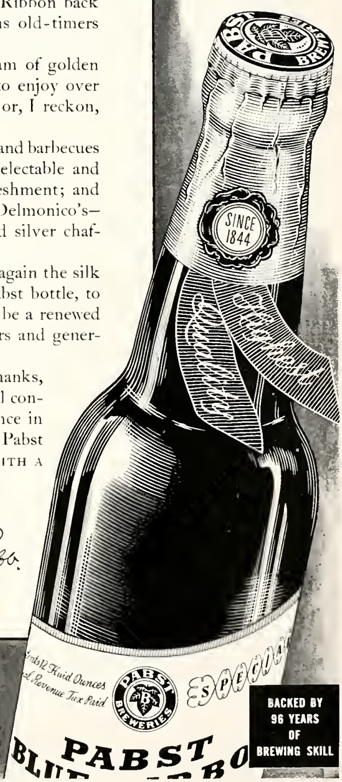
Irvin S. Cobb.



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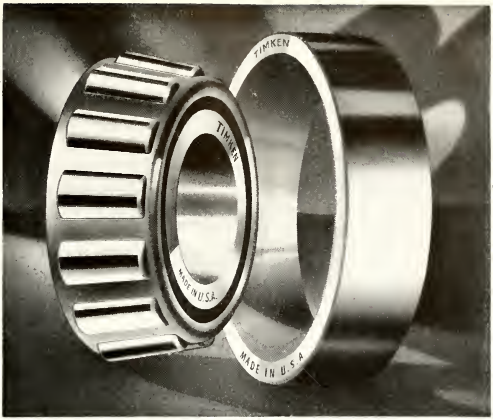

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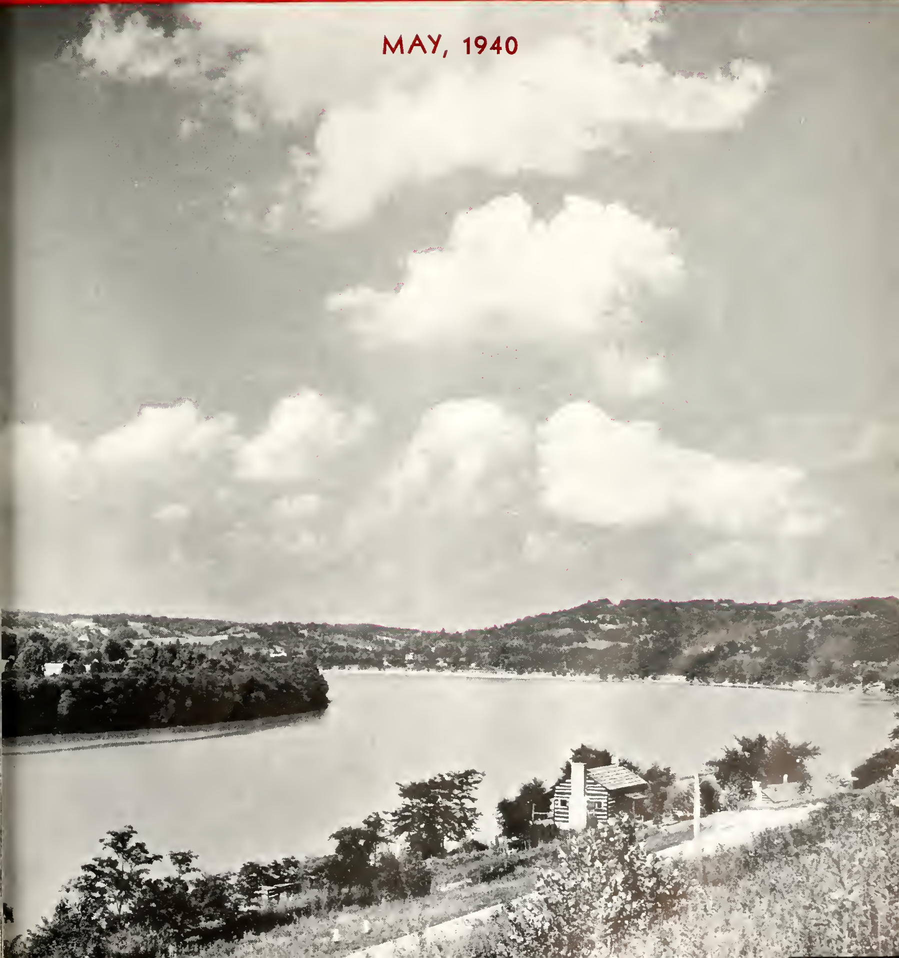
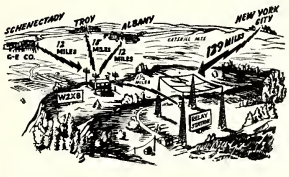
ARMOUR ENGINEER AND ALUMNUS

MAY, 1940



G-E Campus News



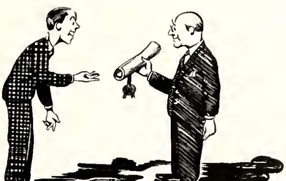
NETWORK TELEVISION

GENERAL ELECTRIC engineers passed another milestone on the road to large-scale telecasting when they recently demonstrated to the Federal Communications Commission the feasibility of network television.

Until a short time ago it was not thought possible to transmit television farther than the horizon. Recently, however, General Electric put into operation its new relay station, picking up programs originating in New York City 129 miles away, more than a mile below the line of sight. The New York programs are then retelecast over General Electric's Schenectady television station W2XB to homes in the Schenectady-Albany-Troy area.

FOR OUTSTANDING ACHIEVEMENT

GRADUATES from seven colleges, five of them also graduates of General Electric's famous Test course, were among the 22 G-E employees who were given Charles A. Coffin Foundation Awards this year for accomplishments which reflected outstanding initiative, perseverance, courage, and foresight.



James R. Alexander, Jr., U. N. C. '24, received recognition for perfecting equipment (developed by Arthur W. Burns, who also received a Coffin award for his work) using an "electric eye" to control temperatures in cement manufacture; Florian A. Arnold, Purdue '25, for designing automatic welding machines used in making fractional-horsepower motor stators; William S. Bachman, Cornell '32, for improving tone reproduction in broadcast receivers; James E. Beggs, Purdue '31, for developing a loop antenna for radio receivers; Eugene W. Boehne, Texas A & M '26, and Leonard J. Linde, South Dakota State '29, for developing a high-current circuit breaker which does not use oil as an insulating medium; Kenneth K. Bowman, Kansas State '26, M. A. Edwards, Kansas State '28, and Francis Mohler, V. P. I. '26, for developing Amplidyne controls for high-powered motors; Adolph F. Dickerson, Texas A & M '10, for lighting the Golden Gate International Exposition; and Simon H. Weaver, Purdue '03, for developing a heat stabilizing treatment for steam turbine shafts.

PHOTOGRAPHING LIGHTNING

PHOTOGRAPHING lightning is almost like trying to turn around and face yourself. By the time you've turned around, you're not there any more. But while nobody has yet been able to look himself in the eye, General Electric scientists have photographed lightning and recorded the wave shape of lightning strokes.

With a high-speed cathode-ray oscillograph and a high-speed camera installed in the tower of the Empire State Building in New York City, Dr. Karl B. McEachron, a former G-E Test man, directs the study of the characteristics of lightning. The lightning stroke itself "pulls the trigger" and puts the complicated mechanism into operation in one-millionth of a second.

Records obtained in this way help General Electric engineers to build electrical equipment that laughs at lightning—keeps the lights on and the factories running when thunderstorms come.

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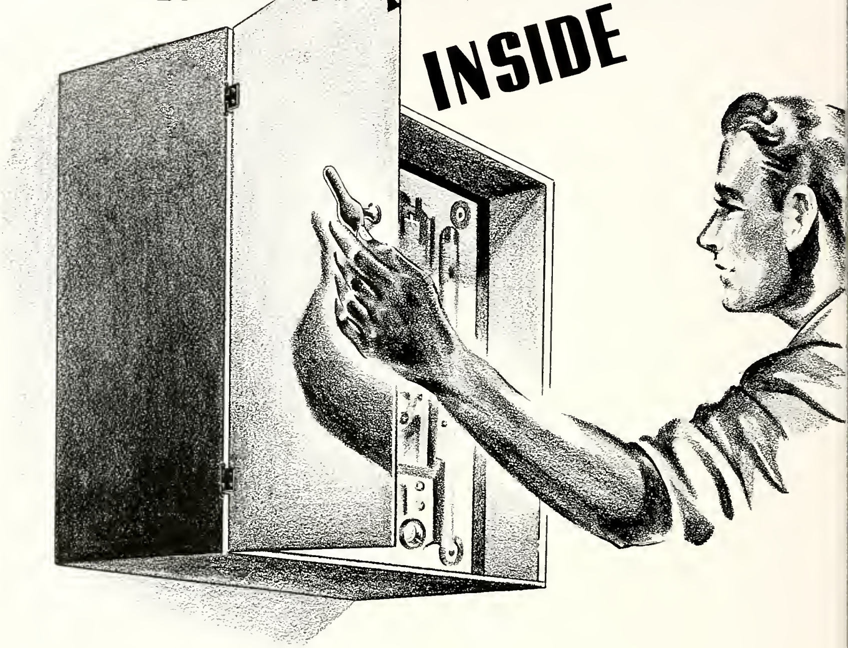

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Contributors

■ HENRY P. DUTTON is Dean of the Evening Division; Professor of Business Management; and Chairman of the Department of Social Science.

■ ROLF ELIASSEN is Assistant Professor of Civil Engineering. He has had experience in the design, construction, and operation of water and sewage treatment plants in various parts of the country, and has conducted experimental work in hydraulics.

■ LORAN D. GAYTON is City Engineer for the City of Chicago. After graduation from the University of Illinois, he was employed on the construction of bridges, buildings, and hydro-electric developments in various parts of the middle west. He has been on the staff of the Bureau of Engineering of the City of Chicago for twenty-six years, and has been City Engineer since 1927. Under his direction have been carried out the design and construction of water intakes, water tunnels, pumping stations, bridges, and a new channel for the South Branch of the Chicago River; the total cost of this work has been many millions of dollars. The South District Filtration Project, described briefly in this issue, is under Mr. Gayton's direction. It involves the largest filtration plant in the world, and the cost will be approximately twenty million dollars. Mr. Gayton is President of the Illinois Society of Engineers, and Vice-President of the Chicago Engineers' Club. He is a past President of the Illinois Section of the American Society of Civil Engineers and an honorary member of Chi Epsilon, civil engineering fraternity.

■ SAMUEL I. HAYAKAWA is Instructor in English at Armour.

■ BLAINE HOOVER is Superintendent of Enmployment and Secretary of the Civil Service Board of the Chicago Park District. He has been associated with the United States Steel C-rparation, the United States Shipping Board and the Yale University Press in assignments relating to time keeping and personnel administration and management. He has been State Director of Personnel for the Illinois Emergency Relief Commission and the Works Progress Administration and has also served as State Director of Employment for the Works Progress Administration. Mr. Hoover's article in this issue is a summary of an address delivered by him at Armour Institute of Technology, for the Society for the Advancement of Management.

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ARMOUR ENGINEER
AND ALUMNUS

MAY 1940
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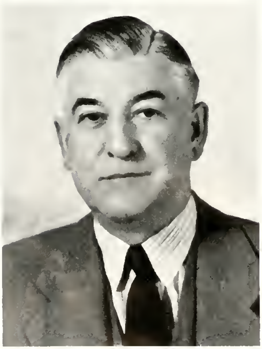
THE CHICAGO WATER SUPPLY

By

LORAN D. GAYTON



Peter Fisk Photo

The Chicago water supply system is municipally owned and operated and represents one of the largest, and probably one of the oldest business enterprises in the city, its history dating back to 1851, when a private company was taken over and enlarged by the municipality. The City of Chicago has had a most remarkable growth, its population increasing from a few hundred souls in 1833 to approximately 3,725,000 people at the present time. The water supply system has always anticipated the rapid increases in population, and has kept pace with the demands placed upon it. From its humble beginning in 1852 it has grown until now the system consists of six intake cribs, fifty-eight miles of water tunnels in service—ranging in diameter from five to sixteen feet—twelve pumping stations, and over thirty-eight hundred miles of cast-iron water pipe, varying in diameter from four inches to fifty-four inches. In the distribution system there are over thirty-eight thousand gate valves and over forty-one thousand fire hydrants.

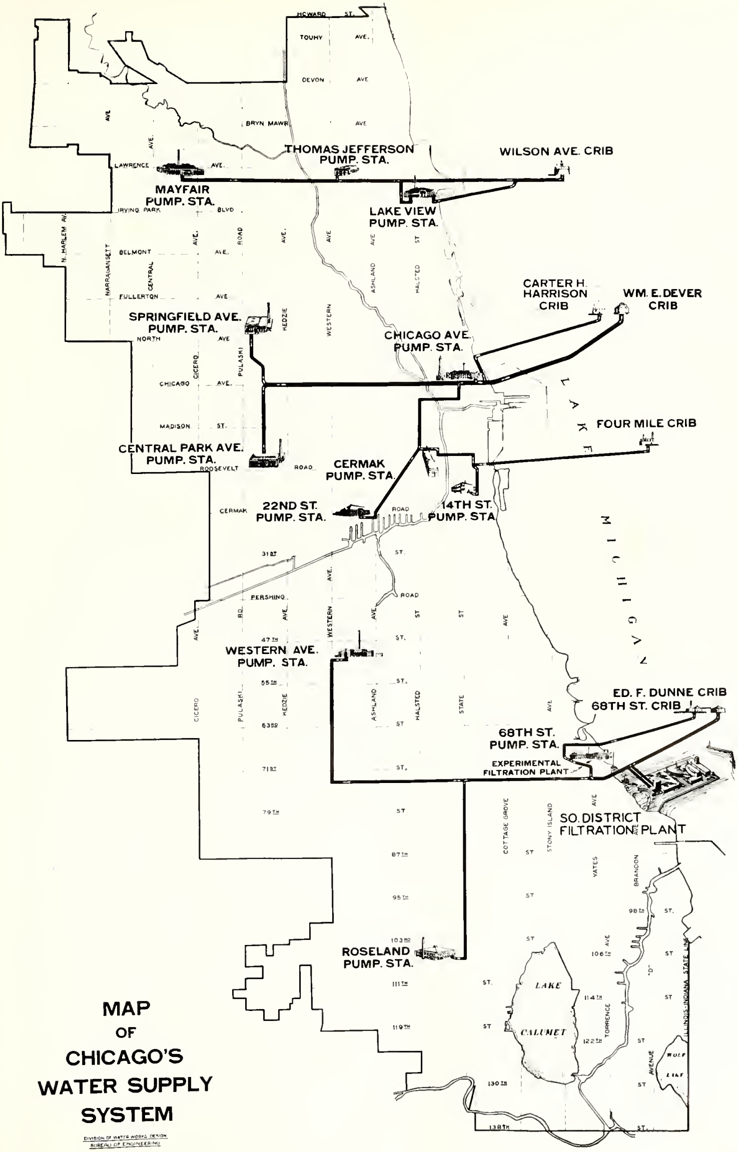
As of December 31, 1939, this system had cost the water users of Chicago \$167,560,000, and had been financed entirely from the revenue received from the sale of water. It is carried on the books of the Department of Public Works at a depreciated valuation of \$135,660,000. At the present time the only bonded indebtedness is about \$32,000,000 of outstanding water certificates, which bear interest ranging from five per cent down to two and one-fourth per cent and are retired in fixed amounts annually.

All money received by the City from the sale of water, or from the sale of water bonds or water certificates must under the law be placed in a separate fund called the Water Fund, and it is unlawful to use the money from this Water Fund for any purpose other than for the operation, maintenance, additions to, or extensions of the water supply system.

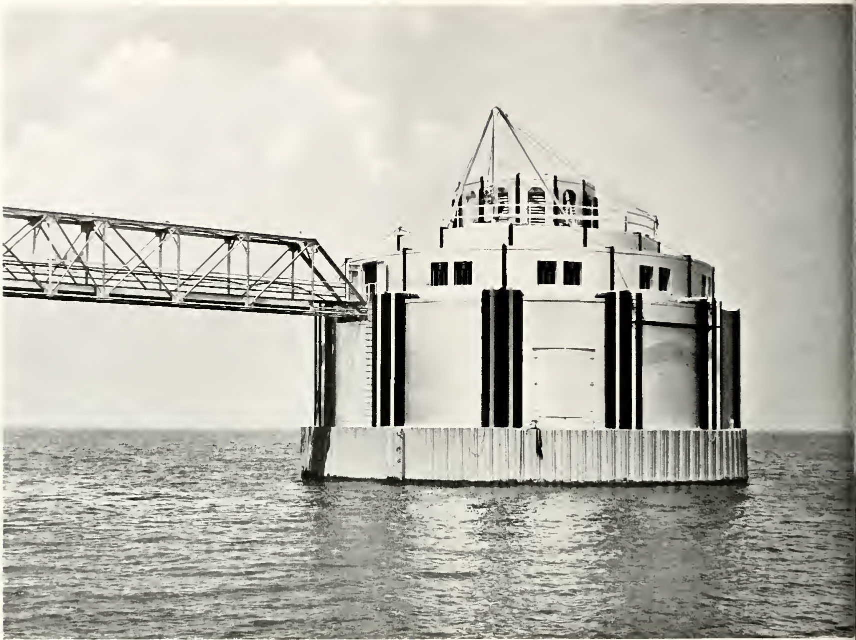
The water supply system delivers water without charge to municipal, religious, educational, and charitable institutions, as well as free water for parks, fire hydrants, street cleaning, and street improvements. During the year 1939 water to the value of over two million dollars was delivered free to such users.

The present water ordinance of the City of Chicago requires that all manufacturing, industrial and commercial users, and all residences for four or more families must have water meters, and also in general, that all users whose bills amount to \$25.00 per annum must have meters. These metered users of water pay a net rate of 6.8 cents per thousand gallons. At the end of 1939 there were 115,042 metered premises paying for water at the above mentioned rate. Under the Sanitary District law the City of Chicago must, upon demand, supply water to any municipality within the limits of the Sanitary District at the same price charged to large users of water within the City limits. At the present time Chicago supplies water to thirty-eight such municipalities.

In general, single, double, and three-family residences and any premise where the bill is less than \$25.00 per year do not require meters but are charged for water under the so-called frontage or assessed rate. In other words, there is a flat rate, depending upon the frontage of the lot, the size of the building, and the number of outlets. At the end of 1939 there were over 297,000 of these unmetered or unmeasured services. It is in connection with these unmetered premises that we find the greatest waste of water, and it is this waste

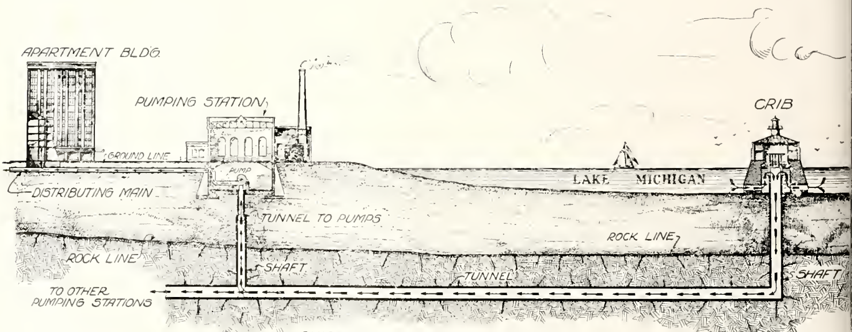


MAP
OF
CHICAGO'S
WATER SUPPLY
SYSTEM



Chicago Arch. Photo (

Above: William E. Dever Crib



CHICAGO'S WATER SUPPLY SYSTEM
TYPICAL CROSS SECTION

that during the hot days of the summer season makes it impossible to maintain adequate water pressure in many parts of the city.

Just to make the picture clear, allow me to state once more: At the end of 1939 there were, in the city of Chicago, 412,228 water services, and of these services 115,042 were metered and 297,186 were without meters. In other words, approximately twenty-eight percent were metered and seventy-two percent were unmetered.

During 1939 the Chicago water supply system delivered within the City limits 335,993,000,000 gallons of water. The average daily pumpage was 920,530,000 gallons, giving a daily average of 2,230 gallons per service, and 247 gallons daily per inhabitant. Of this total pumpage for the year 1939, thirty-seven and one-half percent passed through metered services and sixty-two and one-half percent passed through unmetered services.

The total income to the Water Fund from the sale of water in 1939 was $13,263,586, and of this total seventy-three percent, or $9,718,393 was paid by metered users, and twenty-seven percent, or $3,545,193 was paid by unmetered users. In other words, although the metered users used only thirty-seven and one-half percent of the water pumped, they paid seventy-three percent of the income received from the sale of water.

The larger consumers, such as the Stock Yards and packing industries, railroad yards, large office buildings, laundries, hotels, canning and bottling plants, and cities and towns outside the limits of the city of Chicago, receive water through meters from three to twelve inches in size. At the end of 1939 there were 2,573 of these meters in use. These large consumers took twenty-one percent of the total pumpage and paid thirty-seven percent of the total revenue derived from the sale of water.

It may be of interest to consider the amount of water used by a few of our larger industries:

The Stock Yards and Packingtown take water through numerous connections, and the supply is measured by 113 separate meters. During the year

Chicago Avenue Lake and Land Tunnel

Chicago Arch. Photo Co.

South District Filtration Plant
Panorama View Looking Southeast
From Seventy-Eighth Street

1939 the average requirements of these interests was approximately 23 million gallons per day, but during the month of September the demand reached 26 million gallons per day, and during the month of August, 1934, the Stock Yards and Packingtown industries demanded over 43 million gallons of water per day. The peak load demand of these industries alone exceeds the amount of water required by many of our large American cities.

One canning and preserving plant on the South Side takes an average of about one and three-quarter million gallons of water per day but during the fall vegetable canning season this demand sometimes rises to almost three and one-half million gallons per day. A typical example of a large commercial office building is the Merchandise Mart, which during the year 1939 required an average of over 400,000 gallons of water per day. The Hotel Sherman, during the year 1939, took over 655,000 gallons per day. The Stevens Hotel during 1939 took over 650,000 gallons per day. The average daily demand in August, 1939, was 1,020,000. Western Electric Company, one of our largest manufacturing concerns, takes over 1,900,000 gallons per day, and at one of the Chicago and Northwestern Railroad yards the peak demand sometimes reaches two million gallons of water per day.

As an illustration of the extreme demands which at times the Chicago water supply system must meet and for which those in authority must plan, and for which the operators must be ready at all times, may I call attention to the fire in the Chicago Stock Yards that occurred in May, 1934. Ninety-three pieces of fire department apparatus responded to the various alarms sent out in connection with this fire and these constituted by far the greatest concentration of fire fighting equipment ever known in history. The demand for water was three times that ever before recorded and far beyond any requirements called for by the National Board of Underwriters. A study of the records indicates that a maximum supply of 60,000 gallons of water per minute was delivered by the fire department upon the burning area. This is at the rate of over 86,000,000 gallons per day. On account of the fact that the people of Chicago complied with Mayor Kelly's request that they conserve the water supply, the system was able to meet this ex-

Chicago Arch. Photo Co.

treme demand on a hot summer day and maintain pressures over the entire city.

Industrial progress is now presenting to the Chicago water supply system a new demand for additional large quantities of water. This demand is for water in connection with air conditioning equipment. Until recently air conditioning has been a minor factor in creating water demand. However, in the last few years this industry has made rapid progress and now shows acceleration in the rate of increase.

Air conditioning affects the demand on a water supply system principally through the refrigeration or cooling of air, which is but one function of air conditioning in general. The demand for air cooling occurs during the summer months; the higher the temperature the greater the demand, and this air cooling demand period coincides with the maximum demand from other sources. The air cooling and refrigeration demand occuring as it does with the normal peak of water pumpage represents a direct increase in the required capacity of the system.

In the year 1912, in order to safeguard the consumer against water-borne diseases such as typhoid and other intestinal disorders, sterilization of the water was started at the intake cribs, and by 1916 the entire water supply was being sterilized by chlorine introduced into the water at the various pumping stations. This system of chlorination has been developed from 1916 to date until today it is highly organized and systematized and is one of the major operations of the Bureau of Engineering. Chlorination merely sterilizes the water; it does not purify it. Chlorine makes inactive certain intestinal bacteria which ordinarily bring about such water-borne diseases as typhoid and dysentery, but it does not remove any foreign matter from the water and all such foreign matter as sewage, originally in the water before chlorination, remains in the water after chlorination and is carried on to the ultimate consumer. At times, when the water is highly turbid or muddy, and during periods when phenolic and other trade wastes reach our intakes, the amount of chlorine required for sterilization is so great that the water is highly unsatisfactory in taste and odor. Filtration is the only method of water purification that will give a water supply that is clear, safe, and satisfactory in every way under all conditions, and filtration is

the next necessary step in the development of the Chicago water supply system.

Chicago now has under construction the largest rapid sand filtration plant designed or built up to the present time. At the usual rating of two gallons per minute, per square foot of filter sand area, this plant will have a capacity of 320,000,000 gallons per day and it is being designed to handle a peak hour demand of 450,000,000 gallons per day.

This project was started in the fall of 1938, and to date over 10 million dollars worth of work has been completed or put under contract.

P. W. A. Grant

During the years from 1933 to 1936, the City presented to the P. W. A. five applications for grant and loan, or grant only, in connection with the construction of the South District Filtration Project. These applications were for financial assistance in connection with the construction of the complete filtration project. In July 1938, Honorable Oscar E. Hewitt, Commissioner of Public Works of the City of Chicago again applied for a grant in connection with the Filtration Project, and in August of 1938 the P. W. A. approved of a forty-five percent grant in connection with $12,035 000 worth of work. This sum was the estimated value of the amount of work that it was considered could be carried out within a period specified by the P. W. A. Since approving the original grant, the P. W. A. officials have agreed to certain changes in the various items of work and have also granted the City an extension of time to carry out the construction.

As it now stands, the following units of work are included under the grant: The Breakwater, the Bulkhead or Cofferdam, the Park Fill, the Approach Fill, the Filtration Plant Tunnels, the East Substructure, the West Substructure, the Low-Lift Pumps and Motors, certain Cast Iron Pipe and Fittings, certain Sluice Gates and Valves, Venturi Tubes and Recorders, and the Back Fill for the Substructure. Under our present agreement with the P. W. A. we are required to have all the foregoing construction work completed by March 1, 1941.

Population and Area

The South District Filtration Plant will supply filtered water to three South Side Pumping Stations, the 68th Street, the Roseland and the Western Avenue Stations. The area within the City Limits to be served by this plant, covers 115 square miles or fifty-four percent of the area of the entire City. The present population in this area is 1,387,000 or thirty-eight percent of the City's total population. It is estimated that in 1950 the population will be approximately 1,769,000, and that in 1960 this figure will approach 2,000,000.

For the past ten years, under a partially metered system, the average daily per capita consumption has been 264 gallons. With 100 percent metering the average per capita consumption should be reduced probably to below 200 gallons per day. However, it should be kept in mind, that the area under consideration has possibilities for great industrial expansion and the industrial use of water may keep the average per capita consumption somewhat high.

Plant Capacity

The capacity of the plant is based on a maximum average daily filtration rate of two and one-half gallons per square foot per minute in winter and three gallons in summer. These rates are based upon the use of acid-treated sodium silicate in the treatment of the water to strengthen the coagulation during periods when the floc produced by the use of a simple coagulant only, would not be strong. These rates may be exceeded for periods of several

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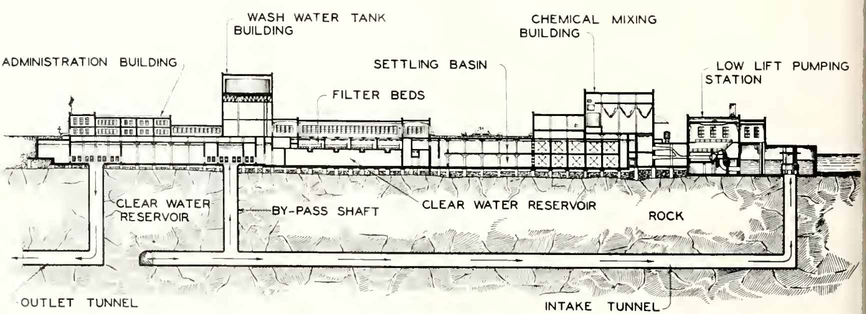


TYPICAL CROSS SECTION
SOUTH DISTRICT FILTRATION PLANT
CITY OF CHICAGO
BUREAU OF ENGINEERING
DIVISION OF WATER WORKS DESIGN

RESEARCH IN SANITARY ENGINEERING AT ARMOUR

By

ROLF ELIASSEN

SYNOPSIS

Research in the treatment of water, sewage, and industrial wastes is being carried out in the sanitary engineering laboratories at Armour. The engineering phases of the work are under the direction of the author. Graduate study in the treatment of sewage and industrial wastes is directed by Dr. F. W. Mohlman, Director of Laboratories for the Sanitary District of Chicago and Adjunct Professor of Sanitary Chemistry at Armour Institute. The graduate work in the processes of water treatment is under the direction of Mr. J. R. Baylis, Physical Chemist in charge of the Chicago Experimental Filtration Plant. The laboratory courses in the chemistry and bacteriology of water and sewage treatment are presented by Mr. E. Hurwitz, Principal Sanitary Chemist for the Sanitary District of Chicago. These men have all made important contributions to the literature of research in sanitary engineering and are actively interested in the research in progress at Armour. The facilities of the main laboratory of the Sanitary District of Chicago have been made available to graduate students for their research projects, to supplement the research work being conducted in the laboratories at Armour Institute.

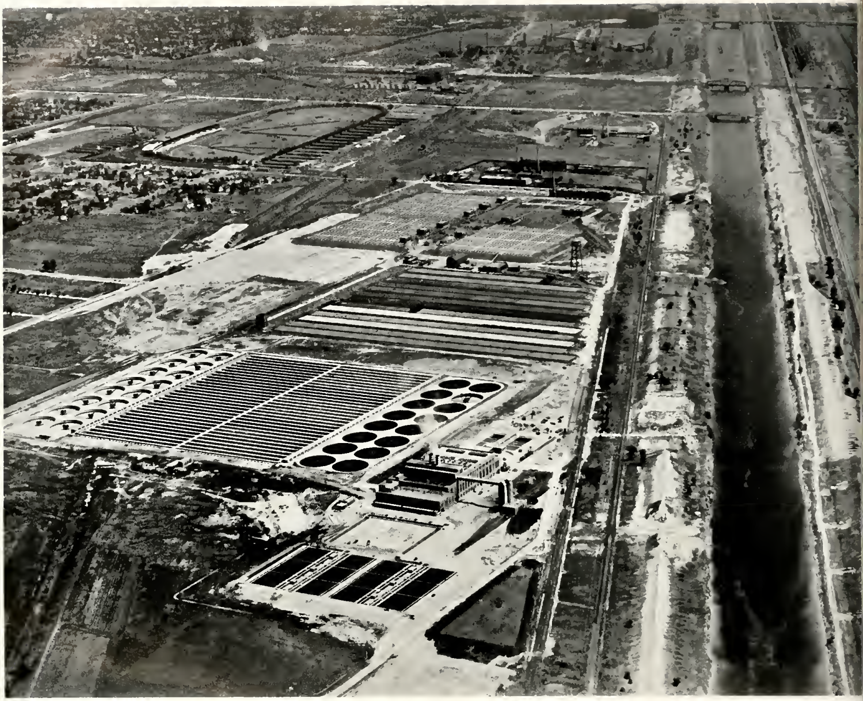
Sanitary engineering is concerned with the safeguarding of public health by the scientific control of man's environment. In a broad sense this includes the supply of water, milk and air, the collection and disposal of sewage, industrial wastes, garbage, rubbish and street refuse, the sanitation of public parks, beaches, buildings and other recreational facilities. The sanitary engineer is directly responsible for two of the most important necessities of our community life, the furnishing of a plentiful supply of safe potable water through our water supply system, and the removal and treatment of the waste water through the sewage disposal system. Our plan of civilization, with its large concentrations of population in small areas, could not safely exist without the benefits derived from research in sanitary engineering and the allied arts and sciences.

Water is the primary requisite for the existence of all forms of life. Although the amount needed for a single individual is small, the requirements of large cities become tremendous when one realizes that it must be supplied in quantities sufficient to meet bodily needs, preserve cleanliness of personal and municipal properties, furnish a means of fire protection, and meet the needs of industries. A city like Chicago requires about a billion gallons of water daily, enough to fill a lake two miles long and a quarter-mile wide to a depth of ten feet in one day. The average citizen does not realize the great amount of work that has been done or the large expenditures made to provide him with an adequate supply of satisfactory water.

In order to be economical, the water supply must be found within a reasonable distance from the city. The available sources may be lakes, ponds, small streams, large rivers, or ground waters. As the density of population increases in the areas from which public water supplies may be obtained, it becomes more difficult to obtain natural waters of satisfactory quality and sufficient quantity to meet the requirements of a public water supply. Some natural waters, even without contamination, are not wholly satisfactory in quality. Most waters in their natural state contain many impurities which make them undesirable for use without purification. Others receive wastes from agricultural, industrial, and human activities which render them unfit for use. The impurities in water may range in character and importance from those that seriously affect public health to those that only cause mild and temporary annoyance. The problem confronting the sanitary engineer is to select a source of water supply which will furnish an adequate quantity and then to design works for the treatment of the water to render it satisfactory from the standpoint of quality.

The chief function of water purification is to destroy or eliminate those impurities that may affect health in any way. Almost as important is the elimination or neutralization, within economic limits, of undesirable dissolved minerals, or other substances, such as those that cause muddiness, color, taste, and odor. The important materials that make water unsafe or otherwise unsatisfactory for use may be classified as follows: Bacteria and other minute organisms that may cause disease or impart color, taste, or odor; suspended or floating materials that cause turbidity, or muddiness, and may also give color, taste, or odor to the water; minerals that cause hardness or have other objectionable effects; and dissolved gases. No one method of treatment will remove all of the objectionable materials in water. There is usually a special treatment process that will remove a particular impurity most economically and satisfactorily.

In the design of a water purification plant it is necessary to select the individual treatment processes that are applicable to the characteristics of the water, and to combine them into a unit that may be well constructed and properly operated. Design must take the operator into consideration; if the plant cannot be properly operated,



Courtesy Sanitary Dist. of Chicago

Photo Chicago Aerial Surve

The new South West Sewage Treatment Plant. In the distance the West Side Sewage Treatment Plant. Combined capacity 872,000,000 gallons daily. The largest installation in the world.

it will not serve the purpose for which it was intended. The purpose is to produce a safe and satisfactory water at the lowest operating cost. It is not enough to provide a plant that can produce safe water; the plant should be so designed that the danger of producing unsafe water through faulty operation will be reduced to a minimum.

The methods of water treatment in general use and the removals accomplished are as follows: 1) Removal of floating materials and fish by screens. 2) Removal of suspended solids and color (a) by sedimentation, or permitting the water to remain almost quiescent in a large settling basin so that the heavier solids may settle to the bottom; (b) by coagulation, or applying to the water certain chemicals called coagulants that produce an insoluble, gelatinous, and flocculent precipitate which absorbs and entraps the colloidal and suspended solids in the water and thus hastens their sedimentation; and (c) by filtration, or passing the water through a layer of sand or other material that strains out the suspended solids. 3) Removal of bacteria, which is aided by the processes mentioned for the removal of suspended solids but is mostly accomplished by disinfection with chlorine to insure the destruction of all bacteria that may cause disease. 4) Removal or neutralization of tastes, odors, objectionable minerals, and dissolved gases, which is accomplished (a) by aeration, or exposing the water in thin films to the oxygen of the atmosphere; and (b) by treating the water with chemicals having adsorptive power, such as activated carbon. 5) Removal of hardness by means of chemicals that convert the substances causing hardness into unobjectionable compounds.

Research in water treatment methods has developed the above-mentioned processes to a high degree of efficiency

which insures the continuous supply of a safe and satisfactory water to the consumer. However, the sanitary engineer and sanitary chemist are continually trying to develop new and more efficient methods to produce a better water at a lower cost. Armour Institute of Technology is playing a part in this development. The experimental filtration plant has been in use for four years and several contributions to the technical literature have already been made as a result of experiments to evaluate the fundamental factors influencing the efficiency of flocculation mechanisms in the removal of suspended matter from the water by coagulants. Studies have also been made on the relation between the time of flocculation and the settling time for optimum clarification at the lowest installation and operating costs.

During the past year extensive studies have been made on a new type of unit known as the Jewell Filter. Difficulties have always been experienced in the washing of rapid-sand-filters through the formation of large objects known as mud-balls. These tend to clog the filter-bed sand and cannot be washed out by the ordinary means of having a strong current of water coming from the bottom of the filter. The Jewell filter unit serves a double purpose in that it is a cell located beneath the surface of a regular sand-filter and is used in the filtering operation as well as for back-washing of the clogged filter. By increasing the area of sand-bed with which the water first comes in contact, it has the effect of decreasing the rate of filtration, in gallons per square foot of surface area per minute, the present criterion of filter loading. This brings about a longer length of filter-run before the filter becomes clogged and must be washed again. The unit also permits surface washing of the filter by issuing horizontal jets of water at velocities high enough to break up any possible mud-ball formation. Although the wash-water still comes from the bottom of the filter as well as from points near the surface of the sand-bed, the combination of the two washes is so much more efficient than the standard bottom-wash that an appreciable saving in wash-water is accomplished. This, together with longer filter-runs, makes possible a considerable saving in operating costs. The results of these and other tests were so convincing that it was decided to go from the Armour Institute twenty-five-gallon-per-minute pilot plant to the much larger experimental plant of the City of Chicago, where full-sized plant tests could be made. If the results are verified on the larger installation the unit will then be ready for regular use. This work is being done under the supervision of Mr. J. R. Baylis, Physical Chemist for the City of Chicago, and Director of the Experimental Water Filtration Plant. Mr. Baylis is also teaching graduate courses in water treatment at Armour Institute and is advisor on the research in water treatment.

This serves to illustrate the technique of research employed on sanitary engineering projects. A funda-

Experimental Aeration Tank with Porous Plates for Air Diffusion

mental study of the factors governing certain phenomena is carried out in laboratories where each of the variables may be controlled. Following this, a mechanism or process is developed which can meet the conditions and achieve the purpose imposed upon it as a result of the discoveries made in the fundamental research. These new developments are then tried in the laboratory on a model scale in order to ascertain the validity of the conclusions previously drawn. If the experiments are successful, larger units are built and tried out in a pilot plant large enough to simulate operating conditions to be expected in plant practice. In the model and pilot-plant stages flexibility is provided in the experimental layout so that changes may be frequently made and the equipment and processes improved and developed at a reasonable cost as the experiments proceed. If the results are conclusive from the model studies it may be possible to eliminate the use of a pilot plant and proceed directly to large installations. However, the work with the pilot plant usually gives such a splendid opportunity for the refinement of methods, technique and equipment that it has proven extremely worthwhile. When the research is finished and the results are analyzed the engineer is ready to design his large-scale plant to incorporate the benefits derived from the research. Further improvements can frequently be made after experimenting with the large plant. The need for research never ceases as long as the engineer strives toward higher efficiencies at lower operating costs.

Fundamental research is now in progress in the important field of water softening. The hardness in natural waters is mostly caused by the presence of bicarbonates and sulphates of calcium and magnesium in solution. These salts may be changed to the insoluble compounds, calcium carbonate and magnesium hydroxide, which settle out of the water in large settling-basins. This is accomplished generally by the addition of lime and soda ash. Fundamental studies of the characteristics of the reactions involved are being made in the laboratory of A. I. T. with the aid of a battery of stirring devices which simulate the coagulation mechanisms in the full-scale treatment plants. As this work progresses, similar studies are being made in the pilot plant to secure a correlation of results and to verify the conclusions drawn from the previous analysis. A clearer understanding of the factors involved in this problem and the relation between them, together with the clarification and filtration properties of the softened water, should lead to a more enlightened design of water-softening plants and greater economies in operation.

Domestic sewage is considered one of the most objectionable and oftentimes dangerous waste products of modern life. Even after the sewage has been flowing through many miles of sewers, it still retains its power to cause nuisance and disease, if allowed to flow free in the watercourse into which the sewers empty. Public health considerations, as well as esthetic reasons, demand that the sewage be treated to reduce or eliminate the objectionable characteristics. If domestic sewage is discharged directly into a small stream or lake, it will render the water offensive to sight and smell; floating matter will form and serve as a breeding ground for flies; fish may be killed; and the stream will be so contaminated as to make it unfit for domestic, industrial or recreational use for many miles downstream, even though the stream be a fairly large one.

The organic matter in sewage is unstable and changes continually take place through biochemical reactions as a result of the bacteria feeding on this matter. In the treatment of sewage it is necessary to remove enough of the organic matter so that the stream into which the effluent from the treatment plant discharges will not be overloaded or made unfit for use. The particular method of sewage treatment to be adopted will depend on local conditions. Primary treatment may consist of: screening, or the removal of the coarser solids by passing the sewage through screens; plain sedimentation, or the passage of the sewage through a settling tank to permit the heavier suspended solids to settle out from the liquid; the coagulation of the sewage particles by slow agitation to produce a flocculent precipitate, with or without the addition of chemicals, and subsequent settling. Secondary treatment employs biological methods to oxidize the organic matter. These are as follows: the activated sludge method in which the sewage is aerated for a period of from three to ten hours in the presence of abundant bacterial life, after which it is settled; and trickling filters, in which the sewage is passed through a bed of broken stone, the surfaces of each small stone being covered with a film containing active bacteria which come in contact with the sewage and bring about oxidation. Variations and combinations of these methods are in use for the treatment of the liquid. The solid matter which is removed from the liquid contains the putrescible organic matter and requires further treatment. This is usually done by placing the sludge in a tank and letting it ferment as the bacteria decompose the organic matter. This process is known as the digestion of sludge. After passing through the digester the sludge is permitted to dry on sand beds, after which it may be disposed of by dumping or used as a low-grade fertilizer having good humus value. The sludge may be dried without digestion, in which case more of the fertilizer value is recovered. Both of these methods are in use at the large Chicago treatment plants, one of which recovers 240 tons of fertilizer per day.

Research in sewage treatment practice is progressing rapidly. During the last ten years great strides have been made to advance the science. On account of the complexity of the organic matter in sewage, the sanitary engineer must draw on the services of chemists and bacteriologists, as well as the allied fields of engineering. Armour Institute is fortunate in having close cooperation with the Sanitary District of Chicago, one of the leading organizations of its kind in the country. The Director of Laboratories for the District, Dr. F. W. Mohlman, is Adjunct Professor of Sanitary Chemistry at Armour and has charge of all of the graduate course in Sanitary Chemistry, as well as the allied research projects. Mr. E. Hurwitz, Principal Sanitary Chemist for the District, is Instructor in Sanitary Chemistry and teaches the laboratory courses in water and sewage chemistry, also taking an active interest in the research work. The facilities of the main laboratory of the Sanitary District at the new Southwest Sewage Treatment Plant have been made available to the graduate students at Armour. At the present time a candidate for the Doctorate in Sanitary Engineering is conducting research at this plant on the important subject of the determination handling and treatment of grease in sewage treatment plants, under the supervision of Dr. Mohlman. Comparatively little is known about the properties of sewage grease and the fundamental factors governing its behavior. These are being evaluated by experimental and theoretical studies on a laboratory scale, after which it is hoped to apply the principles and methods developed in the research to the question of the disposal of grease and scum at the Southwest plant, the largest activated-sludge treatment plant in the world, with a capacity of 400 million gallons daily flow of sewage. As yet, the problem of handling and disposal of grease has not been solved on a satisfactory basis. The results of this

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SOME ENGINEERING ASPECTS OF NAVAL STORES PLANTS

By

EDMOND F. SISSON

The term "Naval Stores" is a generic name, used several hundred years, to identify the products secured from oleoresin by destructive distillation of yellow pine trees. In the days of wooden sailing ships, these materials were extensively used for caulking hull and deck seams and in the paint protecting the entire ship. Up to thirty years ago there were virgin forests all along the Gulf and South Atlantic Coasts, which yielded large quantities of these very much desired materials. Second-growth trees still account for over seventy percent of the United States' primary production.

Rosin and turpentine have been produced during this period and in this area by scarifying the trunk of the tree, collecting the gum which exudes, distilling it in crude direct-fired copper stills, using water to produce a simple steam distillation of the turpentine. As these forests were cut off there re-

Stump Wood Storage Yard

Yellow Pine Stump Wood

mained enormous acreages of stump land. Probably as early as 1900 there was interest in securing the rosin and turpentine known to be contained in these stumps, but it was not until some ten years later that commercial plants were started which employed these stumps as a raw material. Their first efforts were like those of most infant industries, productive of products of questionable quality and at costs in excess of the then common method of producing them. The pioneers of this branch of the Naval Stores industry continued with their efforts and ultimately were able to produce a saleable product at a cost which, while then not economically attractive, showed promise.

The principal consumers of rosin, according to the last report of the U. S. Department of Agriculture, in order of their respective consumptions are manufacturers of paper size, soap, paint and varnish, chemicals and pharmaceuticals, ester gum and synthetic resins. For the last reported year, (1938-1939) the total United States consumption was 1,168,728 barrels of 500 pounds gross.

The principal consumers of turpentine are manufacturers of paint and varnish, chemicals and pharmaceuticals, shoe polish and shoe materials, with a United States consumption of 420,000 barrels of fifty gallons each.

Rosin and turpentine markets are maintained at Savannah. The price fluctuation in these materials has been extremely wide. For example, over the past thirty-eight years the low for "G" rosin was $1.30 per standard of 235 pounds in the year 1901, and the high $15.85 for the year 1919. With such possible variations in return for production, low processing costs of necessity become extremely important.

The solvent process of Newport Industries, Inc. for the extraction of rosin, turpentine and pine oil from stump wood has changed materially from that employed at their first plant at Bay Minette, Alabama, in 1912. This operation turned out a dark rosin, an objectionable-smelling turpentine and a material known as pine oil, which, while pleasantly odored, had then no known use.

The original process used stumps, which had been dynamited from the

ground; they were fed to "hogs," followed by hammermill type shredders. The resulting wood varied in size from match-splinters to pieces with a greatest cross-dimension of one-half inch. This wood was fed on belts to vertical steel retorts holding approximately five tons; these were six feet in diameter, and approximately seventeen feet on the straight side. In these retorts steam was admitted to distill the turpentine and some of the pine oil. After the steaming operation, petroleum-naphtha at elevated temperatures was pumped through the retorts in a series cycle to extract the rosin and residual pine oil. On completion of this operation the "liquor" contained in the last retort in the cycle was blown by steam to the head retort in the cycle and the wood in this retort was then steamed to recover the remaining solvent. This operation was stopped when the condensed steam coming over showed it to be free of naphtha; the retort was dumped and the extracted wood fed on belts to the boilers to produce steam for the process.

The crude turpentine was then steam-distilled, at first without any effort at fractionation, and later using simple ring-filled columns. This provided a separation between the turpentine and pine oil. The rosin liquor was then passed to batch stills where the solvent and pine oil and similar terpenes were recovered by steam distillation.

Operations today are in the main similar to this except that the turpentine steaming is eliminated and all of the extractable material is removed by means of naphtha. The liquor so produced passes to primary vacuum-evaporators which remove the bulk of the solvent, and the evaporator concentrate-liquor is fed to batch stills. Steam distillation is employed to remove the remaining solvent and furnish a mixture of solvent, turpentine and pine oil and finish the rosin to a specified melting point. The condensate, a mixture of solvent, turpentine and pine oil, is then frac-

Rosin Ready for Shipment

View in Pale Rosin Processing Building

tionally distilled in plate-type columns under vacuum to make a separation of these three materials.

For many years solvent Naval Stores plants contented themselves with the sale of an FF grade rosin, a .933 gravity yellow pine oil, and a ninety per cent turpentine. In the meantime pine oil had found a market for itself for flotation and it moved to this consumption in large quantities.

The steam-distilled Naval Stores industry historically may be divided roughly into three periods. The first may be described as the mechanical development period, in which every effort was extended to develop the plants to make them reliable mechanically and reach a sufficient capacity to economically produce three simple products. The second period may be known as the product improvement period, wherein extensive research was carried out to standardize and improve these products and in the case of rosin to make it possible to produce the various color-grades at will. The third period brings the industry into what may be called the chemical phase, wherein research developed processes to so modify the basic products that their character was materially changed and going further to use these basic products as a starting point for the production of fine chemicals. In the case of Newport Industries this has resulted in the production of terpineol, fenchone, anethol and camphor, not to mention rosin of grades more pale than X, and with melting points more than twice as high as the original dark rosin.

The steam-distilled naval stores plant is unique in that in purchasing its raw material it also purchases the bulk of its fuel supply; in fact, where only the simple operations are carried out there is an excess of fuel, and boiler efficiency is of practically no concern. As the ramifications of the operation increase and additional processing is done on the basic products, the question of boiler efficiency becomes of prime importance. This

transition in point of view occurs as soon as the natural fuel supply must be augmented.

In 1934, at the Pensacola Operation, the ton of wood processed required 7700 pounds of steam generated, whereas in 1939, the ton of wood processed required 8500 pounds of steam, despite the fact that a steam saving of over fifteen percent had been accomplished during that period by a change in the basic operation.

Again electrically, in 1934, a ton of wood processed required thirty-one KW hours whereas in 1939 it required thirty-six KW hours.

Water used for condensing and general plant purposes amounts to roughly 17,500 gallons per ton of wood, or stated by comparison, for a 500-ton plant enough water to supply an average city of 50,000 people.

Naval stores plants, handling as they do, large volumes of solvent, must, in order to keep down vapor losses, not only condense their distillates but sub-cool them to be able to operate with solvent losses of a low order.

From the figures cited above it is apparent that the generation of steam is one of the important operations in a naval stores plant. In the early days of these plants when fuel in the form of spent chips was somewhat of a disposal problem, no effort or study was given to ways and means of securing the maximum number of pounds of steam per pound of wood. They, like saw mills, used a simple Dutch oven with flat grates on a horizontal tubular boiler. It was only when auxiliary fuel had to be purchased that thought was given to methods of burning wood which would yield maximum efficiencies.

When these increased efficiencies were sought it became apparent that the engineering firms then available could guarantee performances of plants burning coal, oil and natural gas, but that there was little background of experience covering wood burning. The number of plants which had this problem was small and it more or less fell to them to solve it for themselves.

Our first efforts led us to an inclined type of grate under suspended flat arches, which were applied to existing low-set water-tube boilers, but which lacked adequate combustion space and resulted in extremely high heat releases per cubic foot of furnace volume at even moderate ratings. As the problem was studied further, it was apparent that there were five conditions essential to high-efficiency burning of extracted wood.

1. A moving fuel-bed, providing means for preliminary distillation of the volatile matter in the wood.

2. A liberal combustion space with relatively low heat-release.

3. Ample means for disposal of sand and clay.

4. Good control of the secondary air required for combustion.

5. A well baffled three-pass boiler.

In the older plants efficiencies ranged from fifty to sixty percent, whereas in the new plants the efficiencies have been built up to seventy-five to seventy-eight percent. In the old plants off-gas temperatures reached maximums of 800 deg. F., whereas in the new plants they are of the magnitude of 500 deg. F., with a reduction in black smoke.

As efforts were made to secure greater quantities of steam from existing boilers, water conditioning became a problem which has in the main been solved by the use of phosphate and sulphuric acid or by the use of phosphate, sodium sulphite and caustic.

Sand carried on the chips adhered to the furnace walls and it was necessary to take the boilers off the line to remove this sand from the furnaces and clean scale about every six weeks. In the new installations a record has been established of over eight months on the line and it is anticipated that this period may be further increased.

With a sizable process-steam-load at low pressure it was early apparent that extraction and back-pressure turbine generators or extraction and condensing units would show good returns. With energy requirements mounting, a high-pressure topping-unit may soon be justified; in fact, the last installed boilers were designed for 485 PSI gauge with space for radiant superheaters.

Mill water at the three plants is secured from deep wells ranging in depth from 240 feet to 650 feet and water production and distribution account for a large portion of power consumed. It has recently seemed economically justifiable to install a forced-draft water-cooling tower, despite the high wet-bulb temperatures which prevail in the areas in which the plants are located.

Material-handling problems may be appreciated by calling attention to the fact that for a 500-ton daily capacity plant, some seventeen carloads of stumps must be unloaded to the feed chain per grinding period. These stumps, carrying sand and of irregular shape, quite naturally require equipment of a most rugged type. After these stumps have been put through the hogs and shredders the material is known as "prepared wood" and from then on, is handled at high speed on belt conveyors until it reaches the retorts. The "spent wood," i.e., after extraction, is removed from under the retorts by means of a drag-chain, in turn discharging to belts which feed the boiler fuel-bins.

Naval stores plants, like others in the Process Industry group employ the following classes of equipment:

1—Tanks; Storage—Pressure—Agitated.
2—Stills; Vacuum and Pressure.
3—Evaporators.
4—Fractionating Columns; Plate—Packed.
5—Vapor Towers.
6—Condensers and Heat Exchangers.
7—Pumps; Piston—Centrifugal—Rotary.
8—Vacuum Pumps.
9—Ejectors.
10—Dowtherm Boilers.
11—Clarifiers.
12—Extraction Retorts; Cylindrical and Spherical.
13—Refrigeration Equipment.

The most important material of construction is still steel, but large quantities of copper and its silicon and zinc alloys, in solid and clad form, are used. Probably next in order of importance is aluminum, generally used in its 2S or 3S form. More recently, i.e., in the past ten years, clad and solid stainless steel in both 18-8 and straight chrome-steel types have been used in considerable tonnage. Our first solid stainless-steel retorts were purchased in 1929; they were of low-carbon 18-8 steel because 14-16 percent straight chrome was then considered not commercially weldable. By 1932 it was welded with ease, and our second lot of retorts were of this material. Occasions have arisen where it has seemed advisable to use stainless steels with the addition of columbium or molybdenum, and 28 percent straight chromium will undoubtedly have application for us, though we have not used it to date. As the industry has advanced further in its chemical phase, lead-lined, enamel-lined and pressed plastic equipment has been required. Naturally investment for equipment per pound processed has kept pace with the increased returns available from this further processing.

Engineering procedure for naval store plants may be roughly broken down into six steps as follows:

1. Preparation of the flow diagram based on the Research Laboratory report of the process and information as to capacity desired.

2. Layout of the equipment, after selection of the sizes of specially designed equipment.

3. Detailed design of the individual pieces of equipment.

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THE ENGINEER IN GOVERNMENT SERVICE

By

BLAINE HOOVER

Gibson Photo

As of 1940, government is our biggest business. And government in consequence has become our largest employer. It is interesting in this connection to note something of the expansion of government employment.

According to the United States Bureau of Foreign and Domestic Commerce, there were, in the United States in 1937, 32,546,000 wage earners. Employed in private industry were 28,782,000; employed in governmental activities were 3,764,000. The largest single factor in governmental employment was the federal government with 1,202,000. The next largest factor was the public school system with 1,200,000; then came city governments with 697,000; state governments with 367,000; county, township, and other smaller jurisdictions with 298,000. (The foregoing figures and number of government employees exclude work-relief employees.)

In other words, the latest available computations show approximately eleven percent of our wage earners to be in the public service. If all the wage earners in the United States were put in one long line, every ninth person would be a public employee.

A comparison of this bloc of employment with that of leading industrial corporations is significant. The American Telephone and Telegraph Company employs approximately 200,000 persons. The General Motors Corporation employs approximately 191,000 persons. The United States Steel Corporation employs 185,000 persons. The total number of persons employed by these three corporations is substantially less than the number of persons employed by municipal governments alone. The total personnel of these corporations is equal to only fifteen percent of the number of persons employed in governmental activities as a whole.

The trend in government employment is to increase the personnel. The history of the increase in government employees would make an interesting volume in itself. In 1830, the federal government had only 20,000 employees; in 1883 or fifty-three years later, it had 100 000 employees; in 1929, 862,000; in 1933, there was, contrary to popular notion, a dip in federal employment back to 856,000. But in 1937, it had risen to 1,202,000 persons. In 1830, the population of the United States was 10,000,000. In the 100 years following, that population was multiplied twelve times. In the same period, the number of federal employees was multiplied sixty times.

Other figures are available which reveal these facts more simply. In 1900, for the country as a whole, the public employed 1,300 persons in every 100,000. In 1930, the public employed 2,600 (or twice as many) for every 100,000 population, and by 1939 this figure had risen to 2,930 persons for every 100,000 of population. The foregoing figures exclude work relief.

The increase in the ratio of government employment to population is accounted for in the main by increased governmental functions. To what extent these governmental functions are new and to what extent they represent an acquisition of functions previously conducted under private auspices we are unable to say on the basis of available statistics. Let's look at the trend of employment in the United States during the years 1929 to 1937 for whatever significance it may have in this connection. Taking 1929 employment as an index at 100 percent, the situation had changed in 1937 to a point where ninety percent as many persons were employed in private industry as in 1929, but the number of governmental employees had increased to 117.5 percent of the number recorded in 1929.

Attempts to predict future trends in this area of employment must be left to those who possess with respect to public policy a cocksureness which I cannot assume. However, I find it difficult to quickly agree with those persons who believe that there are imminent changes in policy which will seriously alter the trends.

It is not clear that governmental agencies in the United States are excessive employers of labor. In the United States, in 1932, the index of government employment was twenty; in Germany twenty; in Great Britain twenty-three and in France in excess of twenty-six. Making correction for the increase in governmental employment in the United States as of 1937, most of which increase occurred in the federal services and which did not have counterpart in Europe, the index for the United States would be 23.7 or approximately the same as Great Britain, and lower than France.

I do not like to have too much significance attached to these figures in the absence of exact explanation concerning their statistical basis, particularly in the case of foreign governments. However, "Once installed—few public services are abandoned."

And there is probably much more than sheer momentum to justify the continuation and extension of these services. In the main, they represent an assumption on the part of government of large-scale initiatives and enterprises of various sorts essential to the rapidly rising standards of living

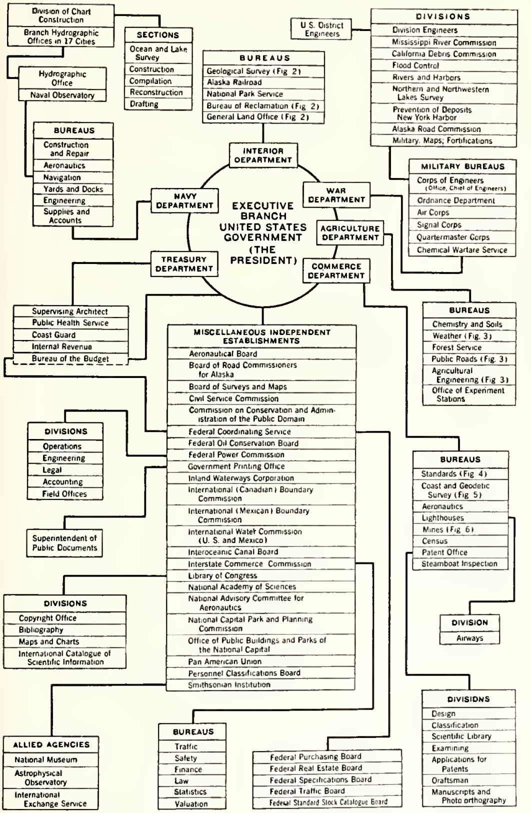

FIG. 1.—FEDERAL BUREAUS EQUIPPED FOR SPECIAL SERVICE TO CIVIL ENGINEERING.

Note: The charts accompanying this article are reproduced from a pamphlet, GOVERNMENT SERVICES AVAILABLE TO CIVIL ENGINEERS, which is No. 7 of the Manuals of Engineering Practice, published by the American Society of Civil Engineers.

of a people; enterprises which by reason of their very magnitude, their community character, or their failure to offer promise of profit must be done by government initiative rather than private enterprise, if at all.

The foregoing is something of a quantitative exposition of the public employment service. Let's look for a moment at certain qualitative features. For purposes of this discussion, I desire only to impress upon you one point and that is that government services tend to be technical to a surprising extent and are tending to become even more so.

Several organization charts, selected more or less at random, may be of some value in suggesting the extent to which certain branches of the government service require technically trained personnel.

We are more or less familiar with the personnel concept of President Andrew Jackson which he expressed by saying, "The duties of all public offices are, or at least admit of being made, so plain and simple that men of intelligence may readily qualify themselves for their performance."

Whatever justification there may have been in Old Hickory's time or personal experience for such a philosophy, I suspect that there are few of us who would care to enter large government buildings or cross the bridges designed by men selected in accordance with this personnel concept to build them.

In 1896, there were only 3,600 professional and scientific positions in the governmental field. In 1930, this number had increased to 35,000. Since that date, the trend to professionalization in public service, along with that in industry, has been strong.

Not many years ago, the public employment of engineers was confined largely to the construction of public works. Today we require aeronautic engineers, automotive engineers, cadastral engineers, geodetic engineers, radio engineers, traffic engineers, airway survey engineers, and many others. Governmental service has been extended in parks and recreation, health, crime prevention, landscape architecture, airports, and irrigation. Additionally, we have such public enterprises as the protection of the forests, the care of veterans, the protection of lives and property at sea, inspection of foodstuffs and weights and measures, and the making of chemical analyses for a thousand purposes. Meanwhile the number and extent of public works has increased tremendously.

In this connection, I cannot leave the point without directing your attention to the importance of "profes-

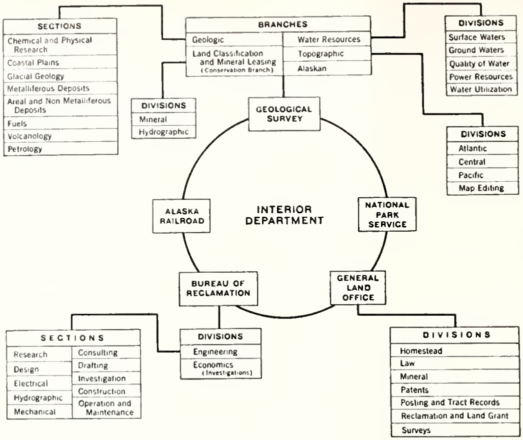

Fig. 2.—Organization of Department of the Interior as Affecting Civil Engineers.

sionalism" in terms of the ultimate efficiency of the public service. Two of the loads which in the past have done much to drag down the efficiency of the public service have been lack of prestige and failure to observe acceptable standards in personnel and performance. Professionalism tends immediately to set standards and to raise the prestige of the service. Indeed, it might be said that professionalism, brought about by the specialization which characterizes modern occupation, is one of the bootstraps by which the public service is lifting itself. The other is the extension of the merit system which tends to promote the same result through the instrumentations of occupational classification and increased tenure in office.

Any attempt at an adequate review of the part played by engineers in public life and the part that public employment plays in the lives of engineers must include reference to the survey of the engineering profession made several years ago by the Bureau of Labor Statistics at the request of the American Engineering Council. Additional supplementary studies made on the basis of and subsequent to the foregoing report have as their background the present general employment situation and may be regarded as having current authenticity. This report, developed on the basis of individual questionnaires, of which 52,589 were returned by engineers, reveals some interesting facts. Perhaps I should state also that any of you who is interested in following up the subject will find the following studies also worth reading: The Report by the Society for the Promotion of Engineering Education, 1924; the study made by the American Society of Mechanical Engineers, 1930; and the study made by the American Society of Civil Engineers, 1934. It is not my purpose here to burden you with the details but rather to give you a few of the interesting conclusions of the report developed by the Bureau of Labor Statistics.

Incidentally, it appeared that between eighty and ninety percent of the total engineering graduates in any one year were confined to the nine major professional classes of agriculture, architecture, ceramic, chemical, civil, electrical, industrial, mechanical, mining, and metallurgical engineers. For purposes of the survey, data was broken down on this basis.

The first conclusion of interest is that engineers as a group are occupationally quite stable. Of the 52,000 engineers reporting, only 4,400 or a little over eight percent were graduates practicing in another branch of the profession than that for which they had qualified in college. The most stable were the electrical engineers with three percent diversion and the least stable were the industrial engineers with thirty-six percent diversion.

The second conclusion is that it is important for the engineer desiring to practice his profession these days to graduate and receive his degree. This is indicated by the percentage of survival in the profession as between graduate and non-graduate engineers. Amongst the 34,000 older engineers, seventy-three percent were graduates. Amongst the recent engineers, that is, those who entered the profession after 1930, ninety-eight percent were graduates. Compared with other occupations, the professional mortality percentage for non-

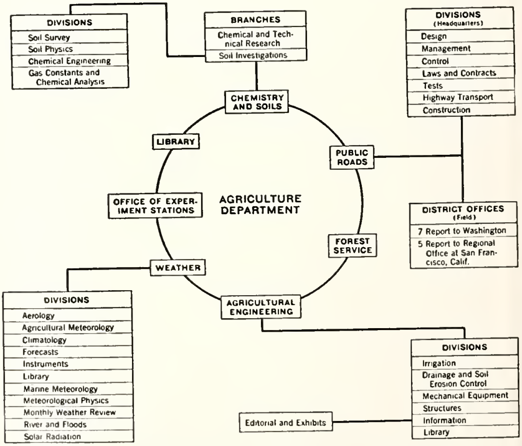

Fig. 3.—Organization of Department of Agriculture as Affecting Civil Engineers.

graduates in the engineering group is high.

The third conclusion is that proportionate employment of engineers by private firms or organizations is steadily decreasing while that of the federal government is increasing. Employment by private firms or organizations was eight-four percent of the total engineering employment in 1929 and only 65.8 percent of such employment in 1934. Were correction made to credit governmental activities with that employment which was governmental by contract, the figure would probably be still lower. During the same period, the employment of engineers by the federal government increased from six to fifteen percent of the total employment and similarly, were such a correction made for work on government contracts, that figure would doubtless be increased. This emphasis in employment is more striking as applied to recent graduates. Only twenty percent of the civil engineers graduated in 1933-34 reported as being in the employ of private firms whereas 34 percent of the electrical and fifty percent of the mechanical were so employed. Last reported trends indicate, however, a slight increase in private employment for electrical and mechanical engineers.

The fourth conclusion is that non-graduate engineers tend to earn more in the earlier years of life than do graduate engineers due to the fact that in securing employment and promotion their experience seems to be accepted as more valuable than training without experience. Non-graduates reach their highest salary level before the graduates, after which their salary curve begins to flatten out while that of graduate engineers continues to rise.

The fifth conclusion is that government employment tends to a lower rate of pay than private employment. However (here I contribute to the report), this does not necessarily mean that the engineer in government work receives a smaller sum-total of compensation. Government engineers generally enjoy longer tenure and much greater benefits in terms of leave, compensation for sickness, and pensions than do engineers in private industry.

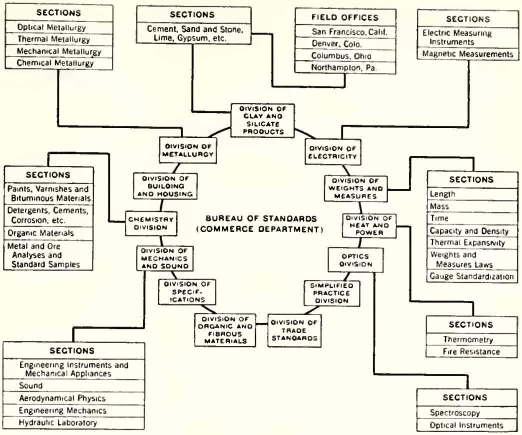

FIG. 4.—ORGANIZATION OF BUREAU OF STANDARDS AS AFFECTING CIVIL ENGINEERS.

And now let's forget general statistics and view the engineer in government work as many of us have come to view him in years of contact with the profession. It has been said that engineering is a method of thinking. Certain it is that the engineer, amongst the men of all professions, is trained in a characteristic form of mental procedure. He assembles his facts, he analyzes them, he derives his standards and applies them, and there comes forth a result adequate and exact. This "engineering" method has come to be recognized as having utility in solving problems far beyond the scope of those traditionally regarded as within the field of engineering. This engineering technique has been found to have great value in the fields of economics, sociology, and indeed, in attacking many of the biggest problems that confront public administrators today.

In the effort to secure an application of this kind of thinking to major problems, the traditional practice of drafting lawyers or non-professional men for major administrative responsibility has fallen increasingly into

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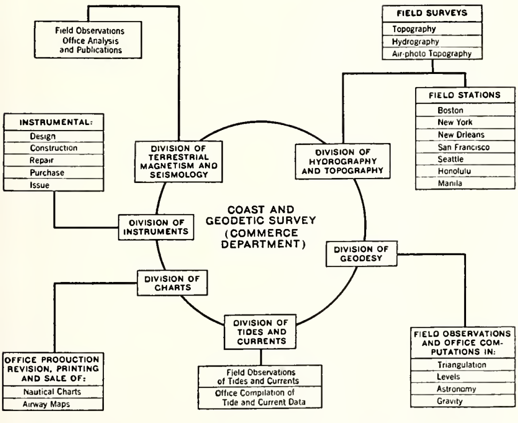

FIG. 5.—ORGANIZATION OF COAST AND GEODETIC SURVEY AS AFFECTING CIVIL ENGINEERS.

WHAT TECHNOLOGY DOES FOR CHICAGO

This article is an abstract from a recent issue of *Millar's Chicago Letter,* published weekly by John H. Millar at 538 South Wells Street, Chicago.—*Editor.*

H. T. HEALD, president of Armour Institute of Technology, in discussing "What Technology Does for Chicago" at the March 20 meeting of the Chicago Association of Commerce, had much to say about the contribution of engineers in public service, as well as the need for training all engineers in social sciences and humanities.

After recalling various outstanding technological contributions made by Chicago engineers in industry, he continued: "The vital period of technological development has been the period of Chicago's greatest growth. While private enterprise has been supplying us with almost every conceivable convenience, government has been providing us with adequate water supply and sewerage systems, bridges, harbors and docks, and other facilities so necessary for health, recreation, and commerce. Great cities like Chicago have arisen through the development of technology, and, perhaps from the same cause, even begun to decline.

"Technology's contributions to Chicago have by no means been limited to those things which resulted from business enterprise. Engineers employed by governmental agencies have for years been giving competent service in designing and building public works. The reversal of the Chicago River to provide a safe water supply was an outstanding accomplishment of its time. More recently, the development of modern methods of sewage treatment by engineers and chemists of the Sanitary District has helped to solve the problem created by decreased diversion from Lake Michigan. Engineers in the employ of the city have successfully developed the modern bascule bridge and are now solving the technical problems incident to the digging of subways. Engineers of the old South Park District were among the early pioneers in the building of continuous steel bridges and rigid frame structures, as recently as fifteen years ago. I think it is safe to say that if we look behind the political figures, who are sometimes regarded with distaste, we shall find hundreds of loyal, competent engineers, many of them leaders in their professional fields, who are continually striving to carry out public improvements on a sound economical basis. It is interesting to reflect that these men usually carry on through one administration and yet another, largely unsung and unrecognized, serving the citizens of Chicago."

One such is Frank Flanagan, Armour '06, who on the day before Heald spoke was named chairman of the Budget Survey Committee, which is to work out plans for effecting constructive economies in Chicago government. Others on the committee are Oscar E. Hewitt, commissioner of public works; Robert Upham, city comptroller; and Graham Aldis, president of the Civic Federation and Bureau of Public Efficiency. The committee, authorized "to make a complete study of the government of Chicago," was officially established by the finance committee of the City Council, at the suggestion of Mayor Edward J. Kelly after many consultations with Oscar Mayer, president, and Leverett S. Lyon, chief executive officer of the Chicago Association of Commerce. The Association will supply funds to increase the staff of the Civic Federation assigned to the study.

Officially, Frank Flanagan is "budget examiner," a member of the staff of the finance committee of the City Council. He directs the preparation of the annual appropriation bill which incorporates the budget of the city. He is a civil engineer by training, whose first job for the city was that of a rodman in the engineering department. He has been preparing budget bills for some fifteen years now. During that time he has served as president of the Municipal Finance Officers Association, a national organization of public officials, affiliated with the Public Administration Clearing House. At present he serves the same organization as chairman of its national committee on municipal accounting. He serves also as treasurer of the Municipal Employees Society, an association of some 6,000 employees of the city. He is secretary-treasurer of the Chicago Municipal Employees Credit Union, with assets around $400,000. He started his habit of being treasurer early in life. The Armour Institute annual for the year 1904 lists him as treasurer of the Sophomore class.

Carl Chatters, executive of Municipal Finance Officers Association, rates Flanagan as "one of the most level-headed persons I know. He is honest, sincere, and doesn't talk too much. He manages to act as a balance wheel to a lot of boys who often do not want a balance wheel." Such is the nature of the man who will direct a study from within, seeking how to make Chicago government more efficient and less wasteful. He understands human factors as well as techniques and finances. "We are going at it in a constructive way," he tells MCL. "You don't accomplish anything by breaking down morale."

Fifteen civil engineers were graduated by Armour Institute of Technology in 1906. Flanagan was one. Others were E. O. Griffenhagen, now head of Griffenhagen & Associates, management engineers who specialize in governmental problems; Ernst Liebermann, chief highway engineer of Illinois; Tenney Ford, assistant chief engineer of sewers for the City of Chicago; Walter G. Leininger, former superintendent of streets, now a paving contractor; Carl O. Johnson, assistant engineer in the bridge division of Chicago's bureau of engineering; Myron B. Reynolds, deceased, formerly city engineer of Chicago; Roy S. Spalding, a WPA construction engineer. Thus eight of the fifteen are or have been in public service. A ninth is in the employ of a utility—Charles S. Holcomb, senior assistant engineer of the Board of Supervising Engineers of Chicago Traction. Tenth is Samuel Klein, president of a firm of consulting structural engineers which bears his name. Another is dead, two others are missing as far as Armour Institute records go, and the remaining two are employed respectively in life insurance and industry.

In the same class, Armour '06 was a young electrical engineer, named Philip Harrington, now commissioner of subways and traction, in charge of a tremendous program of public construction in Chicago.

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INDUSTRIAL RELATIONS AND TRAINING[1]

By

LEONARD J. LEASE

A superintendent suddenly asked, "What do you mean by behavior, Pat?" Taking his pipe from his mouth and looking thoughtfully into space, Pat replied, "Good manners, Boss."

This old world of ours has experienced many behavior patterns. The mammoths and dinosaurs faded out of the picture because they could not adjust their behavior to the changing world. The common ants behave today as they did when they invaded the kitchens of the kings of Egypt. As soon as they are hatched, they know as much as they will ever know, which is enough to meet the environment in which they live century after century. This is the perfection of instinct.

May I direct your thinking to an organism that *can* modify its behavior to its environment and the changes that take place around it? If it cannot make suitable alterations in itself to fit the environment, it is able to change the environment to its liking. Unlike the ants, it is born entirely incapable of surviving by its own efforts and has to depend upon older members of its race for its very existence for about one-seventh of its life span. Unlike the ants, no two of these creatures are exactly alike, nor do they have fixed or unchanging methods of meeting their environment. Not only do no two react to life in exactly the same way, but they may change the reaction pattern from day to day, from year to year, so long as they live.

This generation of men does not respond to life as the preceding one did, and the ones to come may respond still otherwise. Men learn from experience. Their learning prompts them to change the world in which they live, and change necessitates more learning and more adjustment.

Perhaps we human beings, a million years ago, were creatures of instinct; however, the modern scientist tells us that very little in man's behavior can now be classed as instinctive. The new born human animal is an exceedingly complex combination of life cells, and its reactions to the outside world are crude and simple.

A loud noise or apparent loss of support caused by your suddenly lowering an infant which you are holding in your hands, causes a stiffening of muscles, an increase in blood pressure, a catching of breath, and a cry which is interpreted as fear. Should you restrict the action of the arms and legs of the infant by holding them, a somewhat different cry would result, which may be called anger. Feeding and in other ways making the infant comfortable results in a waving of arms and legs, together with a smile and a few noises which indicate happiness or, specifically, the affection instinct. These patterns of action and a few additional reflexes do not have to be learned; they are standard equipment of the human infant at birth. All else is learned.

Since the emotional behavior of the human race is most complicated and most difficult to understand, let us study it briefly. Fear, anger, and affection are called primitive emotions and may be traced to the principle of self-preservation. They are never lost in the adult but, on the contrary, become more complicated. Adults may experience fear by being awakened suddenly at night by an unusual sound, looking down from a very high place, almost having a collision, being suddenly snarled at by a wild animal.

One may experience anger when someone makes a slighting remark about him, borrows his things without permission, interferes with him when he is trying to concentate on doing something he thinks highly important, when he is obliged to do a disagreeable task because someone has shirked a duty.

The emotion of affection may be observed in the adult who wishes to look his best in the presence of a distinguished person of the opposite sex; likes to have people agree with him; enjoys the association of people like himself in nationality, religion, position, etc.; and likes to do things for people of whom he is fond.

Suppose we identify a few basic emotions, i.e.: fear, anger, affection, disgust, wonder, dejection, elation. Don't be disappointed if you cannot identify these basic emotions readily. Psychological studies have been made of photographs and movies of fear, anger, hunger, and pain, in the case of an infant, without the cause of the reaction being known, with the result that a guess with the eyes closed would have been almost as good. Moving picture artists portray these emotions, which you can easily identify because of the circumstances leading up to the emotion. In everyday life you must know the individual and the condition leading up to the emotion in order to identify it. A good poker face might even have you guessing.

Some emotions have an outer and inner response. Suppose you are riding in the rear seat of your car and a second car suddenly crosses your path, avoiding a collision by inches. Muscles of the face, arms and legs react. You hold your breath, and the heart action may speed up or slow down. After it is over, you feel weak. This is the result of a very strong emotion.

As you observe the workers take their places on the job each morning, you read their emotional behavior from eyes, mouth, speech, gait, the way they handle their tools. These may be external reactions to fear, anger, disgust, or dejection and may be the result of a prospective three-day week, an argument with the landlord, a scolding by husband, wife, or parent, or because the street car or bus did not stop. The effect on production or safety are the same whether the cause is within or without the plant. Some individuals may not show external reactions for these same causes, but may experience internal reactions such as loss of appetite, headache, or abnormal glandular action. Brooding or worry may be considered mental reactions.

1. A talk given a group of operating executives as part of the extension program of the Institute. Published material has been freely quoted and acknowledgment must be made of special indebtedness to *New Techniques for Supervisors and Foremen*, by Walton, and *Getting Along with People* by Wright.

These same observable expressions of eyes, mouth, speech, etc., may be the result of affection, satisfaction, or elation, with resulting good emotional behavior.

Frederick W. Taylor taught Schmidt how to carry forty-seven tons of pig iron a day to a flat car for a dollar and eighty-five cents, instead of two and one-half tons a day for a dollar and fifteen cents, with no more apparent fatigue. For a number of years, efficiency engineers in large numbers followed Taylor in a study of methods for increasing production per man; then something happened. The efficiency engineer could show how to cut down motions and increase production, but he knew nothing about the emotional reaction on the worker. Behavior patterns could not be recognized on his charts. Management can also take part of the blame for the failure of this otherwise "advance in industrial procedure," because of taking the lion's share of the profits. Henry Ford was among the first to compensate his employees for a generous increase in efficiency. A feeling of insecurity because of these trends, which reduced the number of workers, brought an increase in restlessness which in many cases resulted in unionization. The emotional behavior pattern of fear was not realized by enough industrial and business managers.

An informal organization develops spontaneously as a result of men working together day after day and year after year into a complex pattern of relationships in which each knows what to expect from each of the others. Add a new face to this group and a strained atmosphere exists until a new balance of relationships has been developed and a new stability achieved.

Harold A. Wright, of the Western Electric Company, has made a study of these informal organizations and has found that many complaints and grievances are the result of feelings of insecurity because of changes in the balance of the groups. Technological and personnel changes had a tendency in some cases to react emotionally on both supervisors and workers during adjustment periods. Meeting arguments with counter arguments, and increased pressure from above, seemed to make matters worse.

Wright set up a technique of personnel counseling to relieve these emotional disturbances. A personnel counselor or interviewer was assigned to a department, whose duty it was to listen to complaints and grievances, but who had no authority to take any kind of action or give advice. The counselor encouraged the individual to talk, and the telling of the story helped the employee to think through his own problem and make his own adjustments.

One case will show how the plan works. A girl on an assembly line served by a conveyor started to cry one afternoon. When asked by her foreman as to the trouble, she complained that the conveyor ran too fast and that she could not keep up. The supervisor was at a loss to understand the girl's complaint, because she had been on the job a long time and had had no trouble before. The counselor's attention was called to the case; after a two-hour interview, a solution to the problem was started.

The girl had been recently married, and she and her husband had rented a first floor apartment from his parents, who lived on the second floor. The close association with her mother-in-law, whom the girl increasingly disliked, developed a situation which she thought was intolerable.

The counselor had two problems; one, to help the girl in her home situation; two, to improve her relationship with her supervisor, whom she had misinformed. The counselor encouraged her to tell the supervisor part of the facts; this procedure immediately eliminated the job troubles. The home situation took more than one interview in which the girl talked freely of her situation, being less sure each time of the exact nature of her dislikes, until she decided there was no good reason at all for them. She did not move. The job went along satisfactorily.

Other similar investigations have shown that small irritations affect the emotions and that they must be recognized and removed in order to maintain a smooth-running organization. A St. Louis department store made such an investigation, finding among other things that there was a desire for recognition of good sales, extra work, and similar minor factors.

The Western Electric interviewers are not psychologists, as you may suppose; in fact, the star interviewer is not a high school graduate. However, they are trained by psychologists.

An exhibition of learned behavior may be observed in the complex behavior of a fullback in a tough game, a violinist executing a symphony, a machinist grinding a piece of metal to one ten-thousandths of an inch. The gap between the infant and the artist is filled with learned responses which mould the behavior pattern. The first time the infant sees its mother put on her hat and coat, pick up her pocketbook, go out to the garage, unlock the car, put the infant in the car saying: "Baby want to go bye-bye in auto," the mother's actions and words have little significance in connection with the pleasure of the ride. Continued experience of the child sets up a learned pattern of "ride response" in the child at the sight of any one of the actions of the mother, and the sentence, "Baby want to go bye-bye in auto." The habit of associating the word "auto" with the ride experience is the beginning of the learning in the realm of words. Running to the garage at the sight of the car keys is a complex response on the part of the child, which includes muscle learning. For a time the child ties its shoe laces with difficulty; then the muscle learning becomes independent of verbal learning, at which time it may be said that the response is a habit. Suppose you try describing on paper the several motions required to tie a double bowknot in your shoestring, without anything available to tie one. You can tie a good one with your eyes shut, *but* could you describe it on paper so that a wooden-shoe Dutchman who had never seen one could duplicate it? The learned muscular habit has freed the act of verbal association. Did you ever try to explain a brand new job to a good mechanic and conclude, "Gee, that fellow is dumb?" The verbal instructions sometimes do not carry the needed amount of detail, because verbal association of the job and the muscular learning of the instructor doing the job may not be the same.

Remember stopping at a gas station for instructions to get some place and how you stopped at about two more before you got straightened out. You did not learn the route; you just listened to it.

Verbal instructions on how to do a job are usually not learned in one or two tellings and a demonstration. The supervisor who goes over the instructions slowly, then asks the learner to repeat his instructions, will usually get quicker results. The supervisor must be patient and encourage the learner as he improves, than have him go through the machine process slowly, if possible, while repeating it. Such a process will insure correct methods and accuracy of production. Where a several-step process is to be learned, the learner should start at the beginning each time and learn to repeat the several steps in proper sequence.

Industrial psychologists recommend that where a process is long and difficult, requiring some forty hours to learn, the instruction and concentration be broken at the end of one-half to one hour on account of fatigue due

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EVENING COURSES LEADING TO THE BACHELOR'S DEGREE

By

HENRY P. DUTTON

In next year's Bulletin of the Evening Division, soon to be out, schedules will be published for the first time, showing how the degree of Bachelor of Science in Chemical, Civil, Electrical or Mechanical Engineering may be earned wholly by evening study. Much interest was manifested when a preliminary announcement was made in February and it appears that the degree course will be serviceable to a good many men who have been prevented by circumstances from starting or completing their college work. The plan also provides a logical terminal program for graduates of Junior Colleges.

The schedules soon to be published outline plans calling for the completion of from six to ten credit hours each semester for seven or eight years. These schedules mean anywhere from eighteen to thirty hours a week of total study, at home and in class. Subjects have been grouped in class schedules so that the work may be done in from three to four evenings per week.

Not all students will be prepared to carry full schedules. But with increasing recognition in many kinds of work of the value of the engineering degree, it is believed (and experience in Eastern schools indicates) that there are numbers of ambitious men who are prepared to invest their leisure time in this form of preparation for their future.

It will not be necessary, however, to follow the schedules exactly as published and it is anticipated that, as is the case in other degree-granting evening schools, there will be many who pick up a few credits from year to year until eventually they find themselves within shooting distance of what has by that time become a coveted goal—their degree.

The new plan will not in any way affect the present non-credit courses, nor complicate the requirements of the man who needs only a course or two for some special purpose. It will, indeed, as the program advances and the junior and senior courses are offered, widen the choice of courses, thus incidentally serving the college graduate who wishes to prepare himself in some technical field other than the one studied in college.

The offering of the advanced junior and senior courses, with their long list of prerequisites and consequently limited enrollment possibilities, presents quite a problem. According to the present plan, these courses will be offered in alternate years, so arranged that in either year the advancing student will have available a complete schedule of courses for which he has the prerequisites. The new bulletin indicates definitely the semester and year in which such courses will be offered. While the giving of any class is necessarily subject to a sufficient registration it is expected that these programs will be adhered to closely enough to make possible effective planning of individual schedules.

The great body of Armour alumni scattered through the country may presently find filtering into their ranks a stream of older men who have never worn the green hat nor taken part in a fresh-soph scrimmage. While these men who see Armour only after dark may miss some of the romance of college life, those who have worked with them and realized their seriousness of purpose know that they will worthily carry forward the Armour tradition and standards.

SIGN OF SPRING

By

JAMES C. PEEBLES

It is early April as these lines are written and from all indications it seems likely that we shall have a hard Winter this Spring. Surrounded by cold winds, wet winds, political winds, Winter goes marching on while Spring seems far behind.

In these uncomfortable days we frost-bitten inhabitants of this so-called temperate zone like to amuse ourselves by watching for signs of Spring. Many of the conventional signs, it seems to me, are much like some bids I hear at the bridge tables in the Faculty Club; they cannot be relied upon. For example, the first robin, bold but misguided as a freshman in Junior Week, sometimes appears in February. And the purple martin, conservative as the professor who answers a student's question with "yes and no," nearly always arrives too late.

Much better than these Lorelei is my own personal sign of Spring. Not content to be a harbinger, a mere advance agent sent to announce the imminent arrival of Spring, he brings her with him. Sometimes, like an unwilling pup on a leash, she hangs back a bit, but patience and hard work win out in the end. And so, day by day, and bit by bit, he spreads her charms before us. You see, my sign of Spring is George Roede, landscape gardener and worker of miracles with trees and shrubs. Without him there would be no Spring at Armour. Early in June Summer would come in with a rush, treading on the heels of Winter, and we should pass from frostbite to sunburn without intermission.

Each year at this time, therefore I present appropriate apologies to Schubert while I sing "You Are My Sign of Spring." Sometimes however a sour note creeps in, and this year it seems to have been worse than usual. In fact I must confess that on several of these gusty April days Roede has been in decidedly bad odor with me. A few days ago I was approaching the Institute with a visitor from downtown when we were met with a barrage, silent, invisible, but immensely potent. My friend gasped a bit but, like a good soldier, continued to advance in the face of the gas attack. When we had reached the protection of the Student Union and had regained our breath, he remarked, "Still emphasizing your stock yards tradition, I see." Of course the olfactory abomination that we had encountered was only Roede, in his most beguiling manner, wooing Spring with food for her grass and flowers.

Those of us who remember what our surroundings were like before George Roede appeared on the scene all realize what a change he has brought about. Perhaps, however, we may be inclined to take for granted the trees and flowering shrubs which he has planted, and our knowledge of them may be scant indeed. A talk with the gardener reveals a man with a surprising fund of knowledge about growing things, a fund in which I wish we all might share. It would enhance our enjoyment of the beauty which is coming to life in our midst, and perhaps cause us to watch our careless feet, so the grass and flowers may have a chance.

The trees in the parkway along Thirty-Third Street are vase elms, so-called because they tend to grow in the shape of a vase. They are an improved species of American elm, and hardy enough to withstand the fuliginous breath of a great industrial city. In time we will have our campus elms, without which no educational institution is complete.

The clumps of low bushes set in the sidewalk angles along both Thirty-Third Street and Federal Street are Japanese barberry. In front of the Physics Building are some red barberry, which will be a bank of color all Summer. In the Fall they will be vivid with bright red leaves and berries, a reminder to us city people that Nature's most colorful show is on in the country. At the same time the sumac near the Physics Building will do what it can to provide local color.

In the center of the lawns in front of the Student Union are some specimen trees with dark bark and rather knotty appearance. They are flowering crab, and their leaves and blossoms will amply justify the rather favored position which they occupy. At the northwest corner of the Union, near the bookstore windows, is a clump of flowering almonds and flowering plums. They are small just now but in a few years they will screen the bookstore from the street. In fact it will become a leafy bower where, on drowsy summer afternoons, Stanley and Jesse may enjoy a brief siesta, safe from prying eyes across the street.

As the flowering shrubs bloom this Spring it will be noted that white, pink, and yellow are the colors which predominate. One of the earliest to bloom is the forsythia, which will bear long sprays of pink blossoms, usually before the leaves appear. The sheepberry, dogwood, mock orange, and bridal wreath are all white and they will be found along the west wall of the Union, as well as Physics Building and Chapin Hall. More vivid color is provided by honeysuckle, spirea, and weigelia. The latter is a most satisfactory flowering shrub; we have several kinds along Federal Street, and they produce masses of pink, red, or purple blossoms.

In these brief notes I make no claim to expert knowledge of garden lore. I have mentioned only a few of the many trees and shrubs which have been planted around our buildings. This spring much more planting is being done in the rear of the Student Union, Physics Building, and Chapin Hall. The 1940 graduate who returns for his class reunion in 1945 will see a campus very different from the one he knew in his student days. Roede and Nature are working hard, but sometimes human nature makes their job more difficult than it should be. It's so easy to cut corners when in a hurry but not so easy to replace a broken shrub or revive a badly trampled lawn.

Upon mature deliberation I am ready to forgive my Sign of Spring for his gas attacks these April days, for I know the results will appear in May and June. Beauty will unfold before our eyes these next few weeks and if we will just slow down a bit and take time to look, it will be a valuable experience for us all.

THE BOOK SHELF

By

ELDER OLSON AND SAMUEL I. HAYAKAWA

How to Read a Book. By Mortimer J. Adler. New York: Simon and Schuster, 1940.

A good deal of modern discussion has turned on the duplicity of words. Without words, obviously, we cannot prosecute comfortably any of our public or private ends; we cannot state our desires, doctrines, passions; we cannot say what has been or is or will be; we are in short hermetically sealed; and yet words can betray and mislead, can make us confound fiction with fact and good with bad, and, acting as implements of reason, can utterly destroy all that reason sought to preserve. The difficulty, of course, is no discovery of our own, although much current discourse makes it seem as if it were. Plato recognized it and thought it might be avoided by the dialectician, the living sower of the living word in the soul; Zeno thought its solution lay in the clarity of ideas; Augustine thought it did not matter because, for him, in the priority of soul to body, words could not be the causes of ideas; in short, it would be difficult to find a major philosopher who did not somewhere encounter the problem, and, insofar as it entered the domain of his system, vanquish it. The tendency of modern discussion of this problem, on the other hand, has been to escape the difficulty by simplifying the questions we may discuss, by limiting the modes of our approach—by restricting our use of words to fields where their treacheries would be negligible. The danger of such a solution is that it is negative, that it solves only by avoidance; and the issues which are so avoided are often precisely those which, practically and theoretically, we have most to consider.[1]

1. In a recent convocation address, which has been reprinted in *The University of Chicago Magazine* (March, 1940, pp. 12-14), Mr. Richard McKeon has very well indicated both the restriction and its consequence.

Mr. Adler's book is utterly refreshing because it is positive, because it faces the difficulties posed by symbols and provides instruments by which any average intelligence, properly exerted, can solve them. Unlike most contemporary educators, Mr. Adler has sought, not to simplify methods of reading, but to simplify the statement of his methods; and he has succeeded in shaping plain English to an urbane, pellucid, and gracious exposition. If you keep a score of the number of points made, you will wonder how so easy a style could have been conjoined with such terseness; and if you attempt any logical analysis of the book, you will be astonished at the rigour of his method. In the first part, which is devoted to a general discussion of reading, Mr. Adler carefully makes clear what reading is, in his sense, through an extended definition by division. Reading, in the sense in which this book is instrumental to it, is not a natural faculty, like seeing (if it were, no one would need to tell us how to read), but a skill, a habit of activity; a habit of intellectual activity involving the interpretation of signs; not of natural signs, but of artificial signs, i.e., those symbols which man devises; and not of every artificial sign, but only of words, and not of spoken words but only of printed words. The meaning is narrowed even further; reading in Mr. Adler's sense is distinguished from ordinary reading in the degree and kind of the ability involved, it is turned toward understanding rather than information, it provides knowledge rather than skill, and it begets knowledge by instruction rather than by discovery. When we become good readers, thus, we are admitted to a university the faculty of which is constituted wholly of the authors of the great books; and their tuition is the only one by which men are made really free.

The term *reading* in this elevated significance remains analogical, however; the procedure in reading a practical book differs from that followed in reading a theoretical one, and both differ from the approach which must be employed when the object of study is fictional, i.e., poetic. A good reading will investigate the principles of the work to which it is directed; the means of discovering the principles become the rules of reading; and since theoretical, practical, and poetic works differ in their principles, Mr. Adler offers distinct sets of rules for each kind, insofar as such segregation is practical. The exposition of rules is so carefully undertaken that both the order and the manner of their statement have the strongest justification. The third part of the book completes the exposition of rules—now those for the reading of imaginative literature—and argues the consequence of the discipline, intellectual freedom.

Indeed, it is the magnitude of that reward—the intimate comprehension of great books, and the liberty of the mind which that engenders—which the reader must bear in mind. Mr. Adler offers no dinner-conversation, no erudition on fifteen minutes a day, no vice-presidency as the prize; and he is careful to indicate that it is a prize not to be gained without dust and heat. The self-discipline involved, Mr. Adler admits, will take time; but so do any of the roads to a major good.

I hope that I have not been pedantic in my attempt to indicate what Mr. Adler's book is all about; I hope especially, that if anything here has seemed pedantic, you will charge the pedantry to me rather than to Mr. Adler. *How to Read a Book* is a fascinating and stimulating volume, the product of years of honest and thoughtful reading; it is a book which can hardly be read too early or too late in one's career as a reader.

ELDER OLSON.

Literature and Science: An Anthology. Selected and edited by Grant McColley. Packard and Company.

The selection of readings in English, whether to serve as models in composition courses or the basis for an introduction to literary history and appreciation, is never an easy task when those for whom the selection is to be made are students in technical and engineering schools. The tastes of those who make the selection and those who are to read them are almost bound to clash, since the former are

(Turn to page 47)

HELP! HELP! HELP!

The record of the Placement Department since the March issue of the ARMOUR ENGINEER and ALUMNUS is as follows:

Thirty-two engineers were placed in March, and up to this writing (April 17th) there has been an average of one placement a day for the current month. In addition, a number of part-time and temporary jobs have been filled by our day and evening school students.

At this time last year sixteen industrial concerns had visited the campus. This year thirty industries have sent representatives to Armour, and there are two additional interviews scheduled for this month. This 100 percent increase is extremely encouraging, especially since this is but the second year since the department has functioned as an entity. Twenty-four of the seniors of the Class of 1940 have definitely accepted positions upon graduation; the majority of the companies whose representatives recruited here this year are withholding definite offers for the time being; however, the department feels confident that placement for the Class of 1940 will be very active.

I wish to express my thanks to a number of you alumni who have given leads to this department. Your cooperation has been deeply appreciated, and I want you to know that I personally feel grateful to you and hope that in the future other alumni will remember this office when they hear of openings of a technical nature.

It has been a source of satisfaction that each week brings an added number of placement records into this office. The department is building up satisfactorily and is now in possession of a sufficient number of records to operate efficiently. However, I am still asking for additional records. If you are unemployed or seeking a change of employment, notify this department, giving detailed information regarding yourself. A supplementary letter is frequently found to be very helpful. Oh yes, when you send in your record, don't send in a snap-shot of yourself standing forty feet away from the camera. Send in a good flattering photograph of yourself. A farmer trying to sell his peaches does not cover them with green mosquito netting.

Again I appeal to the alumni on behalf of the seniors who will be graduated this coming June, and on behalf of the twenty-five who will receive their advanced degrees at that time, to let this department know of any technical vacancies that may come to your knowledge. Can you use any of them? Do you know anybody who intends to hire engineers this June? If so—Help! Help! Help!

WANTED

Engineer to initiate tests, draw up specifications for all types of materials, inspect and correct selected materials, etc. Salary $479.17 per month. Job to last six years. Panama Canal.

Sales and sales correspondence engineer. Initial salary $150 to $175, depending upon previous experience.

One to three E. E. or M. E. sales engineers; capable, experienced men from twenty-eight to thirty-six years of age. Must be of good appearance, have pleasing personality and ability. $3,000 to $6,000 per year, depending upon man.

M. E. with experience in designing heavy machinery and machinery for special purposes. Position is out of Chicago.

(Turn to page 48)

PROGRESS ON ARMOUR-LEWIS MERGER

On October 26th, it was announced that the Boards of Trustees of Armour Institute of Technology and Lewis Institute had agreed to combine their respective institutions to form Illinois Institute of Technology. The carrying out of this agreement was subject to the approval of the Court, inasmuch as Lewis Institute was founded by a bequest from Allen C. Lewis, who died in 1877, and his will is the charter of the institution. Accordingly, Lewis Institute filed a Complaint on November 25th in the Circuit Court of Cook County. The parties to this friendly suit were Armour Institute of Technology and the Attorney General of the State of Illinois. The case was assigned to Judge Robert Jerome Dunne, and early in February Judge Dunne held hearings on the Complaint, which were completed on February 20th. He later asked the attorneys to prepare certain other data; on April 16th, he delivered an opinion in the form of a memorandum in which he stated that the Court would approve the consolidation of the two institutions provided that proper precautions were taken to safeguard certain provisions of Mr. Lewis' will, and he instructed the attorneys to prepare a decree along these lines. The Boards of Trustees and the attorneys are of the opinion that the restrictions in the Lewis will, which it will be necessary to maintain, do do not change the fundamental desirability of the merger; consequently a decree is being prepared which will soon be presented to the Court for approval.

FROM YEAR TO YEAR

A RECORD OF ARMOUR ALUMNI AROUND THE WORLD

By

A. H. JENS, '31

1899

SHUBART, BENEDICT, M.E., who is a partner of Shubart & Schloss, has recently moved to 521 Boston Bldg., Denver, Colo.

WHITE, ERNEST CANTELO, M.E., President of The Ansonia Clock Co., is now residing at 328 Pondfield Rd., Bronxville, N. Y.

1900

DEAN, WILLIAM TUCKER, E.E., who is employed by the Carnegie-Ill. Steel Corp., is now residing at 452 Grant, Gary, Indiana.

VIERLING, R. W., Acad., who is with the Kansas Highway Dept., is now residing at 2541 E. Central, Wichita, Kansas.

1901

SWIFT, JOHN BURNETT, E.E., has recently moved to Graylyn Hotel, Miami, Florida.

1904

FRARY, DON R., E.E., has recently changed his address to 73 Southwest 19th Rd., Miami, Fla.

1905

HILL, WARREN EDWIN, M.E., who is Director of the Washburne Trade School, has recently changed his adress to 7100 South Shore Drive, Chicago.

1906

KRUM, HOWARD LEWIS, E.E., who is Vice Pres. of the Teletype Corp., is now residing at 809 North Alpine Drive, Beverly Hills, Calif.

1907

KELKENNEY, ARTHUR ALEN, E.E., who is a Christian Science Practitioner in Detroit, recently became a LIFE MEMBER of the Armour Alumni Assn.

RICHARDS, R. J., M.E., is now residing at 510 Palmetto, Pasadena, Calif.

1908

POLLAK, ERNEST, C.E., who is with the Tetra Company, has changed his address to Box 1702, Orlando, Florida.

1910

MOYSES, HARRY E., E.E., who is employed by The Development & Promotional Engineering Co., is now residing at 30 Irving Place, New York City, N. Y.

1911

JOHNSON, HAROLD SAMUEL, Ch.E., is now residing at 1140 E. Howard Street, Pasadena, Calif.

1913

KNAUS, PETER J., Ch.E., who is Chemical Engineer for Western Electric Co., is now residing at 622 North Lincoln Street, Hinsdale, Ill.

1914

LESSER, DAVID B., C.E., President, D. B. Lesser Co., has recently moved to 2715 Archer Avenue, Chicago.

1915

HUPP, ORMOND ROY, E.E., is now residing at 7521 Coles Avenue, Chicago.

1916

ALTMAN, EUGENE EMANUEL, C.E., who is employed by Felton & Son, Inc., has recently changed his address to 6550 No. Ashland Ave., Chicago.

MANN, ESTES WILSON, Arch., President and Treasurer of Estes W. Mann, Inc., has recently changed his address to c/o John Wood Mfg. Co., 1616 Walnut Street, Philadelphia, Pa.

1917

HALL, KENNETH VETTER, F.P.E., has recently changed his address to General Delivery, Rockford, Illinois.

HARVEY, JAMES D., C.E., President, James D. Harvey & Co., has recently moved to 4822 Kenwood Avenue, Chicago.

1920

LEWIS, BENJAMIN WOLF, Ch.E., who is a Salesman for Wishnick Tumpeer, Inc., has recently moved to 5414 East View Park, Chicago.

McCALMONT, JAMES T., C.E., who is employed by the Chevrolet Company, is now residing at 820 Fifth Avenue, Janesville, Wisconsin.

STEVERS, HAROLD DEFOREST, E.E., has recently changed his address to 1917 Wright Avenue, Chicago.

1921

MALVIN, RAYMOND CLIDE, E.E., who is President of Malvin & May, Inc., has recently moved to 2015 Michigan Ave., Chicago.

MINKUS, ROBERT L., Arch., who was an Architectural Draftsman with the Board of Education in Chicago, is now an Architect in the Municipal Engineer's office, Balboa Heights, C. Z.

SCHREIBER, HERBERT F., E.E., who is an Engineer in the Operating Dept., The Electric Storage Battery Co., has recently changed his address to Villa and North Ave., Elmhurst, Ill.

1922

SLOAN, ARTHUR H., E.E., who is a Salesman for Williams Oil-O-Matic Heating Corp., is now residing at 6646 Stony Island, Chicago.

TWENTY-FIFTH REUNION

CLASS OF 1915

Final plans are being developed by a Committee for the Twenty-fifth Anniversary of the Class of 1915. Quarters have been engaged at the Chicago Tower Club where it is expected that members of the Class of 1915 will meet during the day and early evening, prior to the alumni banquet on June 4. The complete Committee for the Reunion is as follows:

Stanley Moyer Peterson, Arch.
Robert Lee Wilson, Ch. E.
Claude A. Knuepfer, C. E.
Edward John Burris, E. E.
Walter Rietz, F. P. E.
Bradley Carr, I. A.
Oscar Anderson, M. E.
James Leo Mayer, M. E.

Further information regarding reunion plans may be secured through the Alumni Office or from Mr. Knuepfer at 4701 West Division Street, Chicago.

BOARD OF MANAGERS COMMITTEES

SPRING, 1940

Alumni Service Award Key
L. J. Byrne, Chairman
Eugene Voita

Distinguished Service Award
C. A. Knuepfer, Chairman
A. H. Jens
W. N. Setterburg

Banquet Arrangements
Eugene Voita, Chairman
J. W. McCaffrey
J. J. Schommer
W. N. Setterburg

Alumni Trustee
Entire Board of Managers

Marshall Photo

JOHN J. SCHOMMER
Retires as President of Armour Alumni Association

For the past eleven years, the destiny of the Armour Alumni Association has been under the capable guidance of John Schommer who is now retiring from the office of president. Only after long consideration would the nominating committee permit the name of Schommer to be struck from the head of the ticket and only then if Schommer would consent to remain on the Board of Managers as a representative of the Classes 1912-1916.

Examination of the records indicates that John has spent seventeen years in active participation in Alumni affairs. From 1917 to 1919 he was Corresponding Secretary. In '18 and '19 he served on the Board of Managers. In '19 and '20 he was Recording Secretary and in 1929 he began his long service in the office of President, from which he is now retiring. He has been a powerful influence in Alumni affairs on the Armour Institute Board of Trustees where he has served since 1931. He will undoubtedly continue as a member of the Board of Trustees.

His valued experience in Alumni guidance is not lost for he will have full voice as a manager in carrying the Alumni Association through the next four years.

Schommer's entrance to Armour was in 1912 after a brilliant career at the University of Chicago where he excelled not only in athletics but also in scholarship. He received a Bachelor of Science degree at Chicago with his Class in 1909 with forty-nine major credits when only thirty-six were required. He then spent a year and a half coaching at the University of Chicago and during that time acquired twelve and one-half majors towards a doctor's degree, when he decided to enter Armour, where he received his degree in Chemical Engineering in 1912. In 1920 he was awarded the professional degree of Chemical Engineer. He has been in the Chemical Department since 1912 and now is Professor of Industrial Chemistry.

While at Chicago John was the terror of the Big Ten in four sports: football, basketball, track, and baseball. He was All-Western End and All-Western Center in Basketball. He was a member of three Big Ten championship basketball teams and captained the Intercollegiate Champions in 1908. His exploits in football would require a book alone. In track he was a member of one Conference Championship team and in football he was a member of two Championship teams. He was the first to win four major letters in track, baseball, basketball, and football.

Aside from teaching, much of his time is devoted to the Institute Placement Department of which he is Director. He has been Director of Athletics almost since his arrival at Armour. He has been an Analyst and Consulting Engineer for many of Chicago's largest corporations and has been an official in both football and basketball since 1910.

The University Club of Chicago is one of John's favorite haunts. He is active in the American Institute of Chemical Engineers, Society of Illinois Bacteriologists, S.P.E.E., Chemists Club of Chicago, Butterfield Country Club, Owl and Serpent of the University of Chicago, Phi Kappa Sigma, President of the Chicago Club of the University of Chicago Alumni, and member of the Alumni Council and regional adviser.

A man of unselfish interests with a fighting determination to see any job through, John Schommer leaves the office of President with an unapproachable record.

NOMINATIONS FOR OFFICERS OF THE ARMOUR ALUMNI ASSOCIATION

Article X, Section 1, of the Constitution of the Armour Alumni Association, reads as follows:

Before April 15th of each year in which an election is to be held, the Board of Managers shall appoint a committee on nominations of five active members. Two members of this committee shall be selected from the Board of Managers and no other members of the committee shall be members of the Board of Managers. No two members of the committee shall be from the same class.

This committee shall prepare and transmit to the secretary-treasurer not later than the 15th of May, a written list of nominations for the various offices to be filled. The secretary-treasurer shall include this list, together with a statement that an election is to be held, in the announcement of the annual banquet for that year.

Pursuant to this article, the following names are placed in nomination:

For President (two years)
JOHN WARREN McCAFFREY, Ch.E., '22

For Vice President (two years)
CLAUDE ALBERT KNUEPFER, C.E., '15

For Secretary-Treasurer (two years)
WILLIAM NICHOLAS SETTERBURG, Arch., '29

For Board of Managers
(Representing Classes 1902-1906)
LOUIS JAMES BYRNE, M.E., '04

For Board of Managers
(Representing Classes 1912-1916)
JOHN JOSEPH SCHOMMER, Ch.E., '12

For Board of Managers
(Representing Classes 1922-1926)
EUGENE VOITA, Arch., '24

For Board of Managers
(Representing Classes 1932-1936)
STANLEY M. LIND, Ch.E., '32

For Board of Managers
(Representing Classes 1937—Present)
RICHARD N. VANDEKIEFT, M.E., '39

(Note: All of the nominations for the Board of Managers are for four years with the exception of Vandekieft which is for two years.)

Other nominations may be made from the floor, at the time of election, at the Alumni Banquet on June 4, 1940. Election will be conducted in accordance with Article XI, Section 1, of the Constitution, which reads as follows:

Voting shall be from the floor at the annual banquet. The secretary-treasurer will supply ballots to the active members present. A plurality of votes cast shall elect. The president shall appoint a committee of three tellers of election who together with the secretary-treasurer of the Alumni Association will determine the ballot. This committee shall report to the president who shall in turn announce the results of the election before the adjournment of that meeting.

Respectfully submitted

William F. Sims, E.E., '97, Chairman
Edward F. Pohlmann, Ch.E., '10
Edward J. Pleva, Ch.E., '38
James C. Peebles, E.E., '04
Robert M. Krause, M.E., '31
Committee on Nominations

The above was presented to and accepted by the Board of Managers on April 19, 1940.

ALUMNI BANQUET

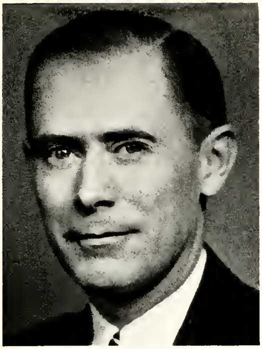
Tuesday, June 4, 1940

CHICAGO TOWERS CLUB

(Formerly Medinah Athletic Club)

505 North Michigan Boulevard

6:30 P. M.



J. WARREN McCAFFREY

Nominee for President of Armour Alumni Association

For many years the spearhead of Alumni activities, the name J. Warren McCaffrey is now placed at the head of nominations for Alumni offices. It seems fitting, after serving as Executive Secretary from 1926 to 1930 and then as Vice President from 1936 to 1940, that McCaffrey should receive the nomination for President of the Armour Alumni Association.

Perhaps the greatest contribution Warren has made in recent years was his work as General Chairman of the Annual Gift from Every Alumnus program which was undertaken several years ago. This program continues under the direction of the Board of Managers who are making further studies in completing the organization work begun by McCaffrey.

Entering Armour in 1918, McCaffrey was graduated in 1922 after completing the course in Chemical Engineering. He received his professional degree from Armour in 1925. He later attended the University of Chicago and received the Bachelor of Laws degree from Chicago Kent College of Law in 1930. He was admitted to the general practice of law in the State of Illinois and to practice before the United States Patent Office.

He is President of the Patent and Engineering Service Company, Secretary and counsel for Du-Ri Products Corporation, Secretary and counsel for Shield Chemical Company and Secretary and Treasurer of J. M. Haas and Company. He maintains law offices in the Conway Building in Chicago.

Mac's biography reads like a page from *Who's Who* and includes membership in the following organizations: Tau Beta Pi, Phi Lambda Upsilon, Alpha Chi Sigma, Triangle, Sphinx, Round Table, Honor A Society, Order of Kent Honor Men, Illinois State Bar Association, The Patent Law Association of Chicago, American Chemical Society, South Shore Country Club, and the American Legion. He is a Captain in the Ordnance Reserve, a member of the Board of Directors of the Armour Chapter of Triangle and President of the Chicago Alumni Association of Tau Beta Pi.

With his wide background in Alumni affairs McCaffrey should bring to the office of President an experience that should prove invaluable during the next two years.

CLAUDE A. KNUEPFER

Nominee for Vice President of Armour Alumni Association

Entering Armour in the Fall of 1911, Claude Albert Knuepfer was graduated from the Civil Engineering Department in 1915. Now on the twenty-fifth anniversary of his graduation from Armour his name is placed in nomination for the Vice Presidency of the Alumni Association.

Knuepfer has represented his class group on the Board of Managers for the following periods: 1920-1922, 1927-1930, 1938-1940. The latter short term was to fill out the vacancy caused by the resignation of Arthur Katzinger, M.E. '16.

Upon leaving Armour, Claude became Superintendent and Secretary of the Automatic Screw Machine Products Company, with which he served from 1915 to 1922. In 1922 he became President and General Manager of the General Engineering Works, a plant that specializes in screw machine products.

During the World War he served as a First Lieutenant in the Engineer Corps and took part in the Meuse-Argonne and St. Mihiel offensives. In all he spent thirteen months with the A.E.F.

His activities include membership on the National Council of the Boy Scouts of America; Vice President and Chairman of Camping and Activities, Oak Park Area Council, Boy Scouts of America; and membership in Phi Kappa Sigma. He was president of the Class of 1915.

Monfort Photo

WILLIAM N. SETTERBERG

Nominee for re-election as Secretary-Treasurer of Armour Alumni Association

The only officer up for re-election is Bill Setterberg, who has handled all of the finances for the Alumni Association during the past two years.

A product of the Chicago Public Schools, Bill entered Armour in 1925 and was graduated in the Department of Architecture in 1929. He has since attended the University of Chicago and has taken considerable work in the School of Education.

Following graduation, Setterberg became associated with John Deere and Company. From 1929 to 1934 he was engineering draftsman in the bridge department of the Chicago and Northwestern Railway Company. He is now on the staff of Armour Institute as Registrar in the Evening Division. He has been Placement Officer and Assistant Registrar.

He is a member of Pi Kappa Phi, Pi Nu Epsilon, Phi Delta Kappa, and A. F. & A. M. He was chairman of Junior activities for the Western Society of Engineers in 1934.

1923

Garland, Benjamin M., M.E., who is Manager of the Marble Division of James B. Clow & Sons, has recently moved to 1303 Pratt Blvd., Chicago.

Pask, Raymond J., M.E., who is District Sales Manager for Servel, Inc., has recently changed his address to 131 S. 39th Street, Omaha, Nebraska.

1924

Grant, David V., M.E., who is Engineer-Custodian of Hyde Park H. S., is now residing at 7740 Ridgeland Avenue, Chicago.

UNGER, PAUL RAYMOND, Ch.E., who is Sec.-Treas. of Mid-West Heat Service Co., has recently changed his address to 823 Drexel Square, Chicago.

WALWORTH, RICHARD HENRY, M.E., who is employed by the Thompson Products Co., has recently changed his address to 1930 Fleet Wood, G. P. Woods, Detroit, Mich.

1925

GLOVER, JOSEPH NELSON, Ch.E., who is Production Engineer, Royal Fire Insurance Co., is now residing at 526 Maplehurst, Ferndale, Michigan.

MEYER, EDWIN MAXWELL, E.E., who is Electrical Engineer, Porcelain Products Inc., has recently moved to Box 648, Rochester, N. Y.

OSTLAND, RICHARD E., C.E., who is now employed by the Warner Construction Company, is residing at Green Mountain Dam, Heeney, Colorado.

OSTRIN, NORMAN, M.E., who is a Draftsman with the Board of Education, has moved to 4505 N. Central Park, Chicago, Ill.

ROSE, GEORGE, JR., M.E., has changed his address to 5085 Mahoning Avenue, Youngstown, Ohio.

1926

ALBER, DEAN L., F.P.E., State Agent for the Home Insurance Co., has recently moved to 14609 Piedmont Avenue, Detroit, Michigan.

BARGER, CHARLES WORK, F.P.E., who has been Special Agent for the Gulf Fire Insurance Co. in Indiana has been elevated to State Agent covering the same territory he previously handled.

BERMAN, WILLIAM, Ch.E., who is a Chemical Engineer for the Cuneo Press, Inc., has recently moved to 6440 N. Claremont Street, Chicago.

TREFF, WALTER R., Arch., is now residing at Wood, Wisconsin.

VISCARIELLO, VINCENT, Arch., who is Architectural Designer for Chicago Park District, has moved to 2943 N. Montclare Ave., Chicago.

1927

BRIGHTMAN, JOHN B., E.E., who is Refrigerating Engineer for General Electric Co., has recently moved to 1138 Glenwood Blvd., Schenectady, New York.

DEAN, HARRY F., C.E., who is still with the U. S. Engineers, now resides at 631 Gorsuch Ave., Baltimore, Maryland.

EMERSON, RALPH WALDO, Arch., who is Associate Architect, U. S. Dept. of Interior, National Park Service, is now residing at 921—19th St. N.W., Washington, D. C.

ENKE, PAUL ALEXANDER, M.E., who is with the Kellogg Company of Battle Creek, has recently moved to 6915 Michigan Avenue, Chicago, Ill.

HALAMA, JOHN PAUL, Arch., who is with the Chicago Park District, has recently changed his address to 1035 North Ridgeway, Chicago.

STEINHAUS, FREDERICK C., Arch., who is Chief Draftsman for Edgar A. Stubenrauch, is now residing at 129 Long Court, Sheboygan, Wis.

1928

DEIWERT, PHILIP SEBRA, F.P.E., may be reached at 342 E. Central, Greensburg, Indiana. He was formerly with the Indiana State Highway Dept. and in the engineering dept. of P.W.A.

GUSTAFSON, CARL A., C.E., who is Sales Engineer for Powers Regulator Co., is now residing at 6234 N. Fairfield Avenue, Chicago.

MINNIBERGER, GEORGE V., M.E., was elected president of the Milwaukee-Armour Alumni Association. He replaces Charles Mark Schneider, F.P.E. '27 who did an excellent job in keeping the Milwaukee group active. George is a Designing Engineer with the Harnischfeger Corp. in Milwaukee.

1929

GEDELMAN, FRED GEORGE, F.P.E., writes this letter to the Alumni Office:

Dear Mr. Setterberg:

I have just been reading with interest the March issue of the ARMOUR ENGINEER and I find that in the notes about the alumni in the group for the class of 1929, the writer is mentioned. The information in the ENGINEER is just a little bit out of date, and it is possibly because things seem to have happened rather quickly within the last year.

Last November I left Eliel & Loeb Company and accepted a position as Engineer-Special Agent with the Fireman's Fund Insurance Company, and in February of this year was appointed State Agent to represent that Company in Minnestoa. I am now located in Minneapolis with offices at 915 Plymouth Building, and have not as yet found a permanent location in which to live.

I have always enjoyed reading the ARMOUR ENGINEER and feel that the editors are doing a fine job and much of the interest in the ENGINEER is, of course, centered in the alumnus news for which you, of course, should have the credit.

With kindest personal regards, I remain,

Yours very truly,

F. G. Gedelman.

GEIGER, ELMER SAMUEL, E.E., who is serving with the Jamaica Public Co., Limited, at Kingston, Jamaica, B.W.I., writes to Alumni President John Schommer in part as follows:

Dear Mr. Schommer:

I have been on foreign work since January, 1930 with the Stone & Webster Engineering Corporation, with positions in the Dominican Republic and Haiti, and was transferred to Jamaica in November, 1938. Fortunately, up to now the tropics have had very little effect on my health.

EWING, NORVAL SCOTT, E.E., who is Patent Attorney for the Bell Telephone Laboratories, is now residing at 15 Esmond Place, Tennafly, N. J.

FORSS, FRITZ VICTOR, E.E., is the proud father of a son, born in Aurora Jan. 31, 1940.

GORANSON, HARVEY EDWARD, F.P.E., who is an engineer for the Tennessee Inspection Bureau, has recently moved to 2707 Capers Avenue, Nashville, Tenn.

JACOBSON, JOEL MARTIN, C.E., Assistant Project Engineer for Glenn L. Martin Co., is now residing at 640 Gittings Ave., Baltimore, Md.

JOHNSON, RUSSELL EDWARD, F.P.E., was recently presented by Mrs. Johnson with a daughter, Ruth, according to reports emanating from Omaha, Nebraska.

KITTLER, MILTON JOSEPH, M.E., who is in charge of aircraft carburetors for Holley Carburetor Co., has recently moved to 18300 Northlawn Avenue, Detroit, Michigan.

1930

BLOMME, EMIL L., C.E., who is in the U. S. Engineer Area Office, has recently changed his address to 910 No. Sheridan Road, Peoria, Ill.

CHUN, EDMUND H., C.E., who is with the U. S. Engineers, is now residing at 307 South 9th Street, Lamar, Colorado.

DOBBERMAN, MARVIN ROBERT, Arch., who is with the Dept. of Agriculture, Univ. of Ill., is now residing at 106 N. Russell Street, Champaign, Ill.

ERLAND, GUSTAVE GEORGE, M.E., who is Law Clerk and Draftsman for Rasmussen & Brugman, has recently moved to 7628 Colfax, Chicago.

FEE, JAMES GARNET, M.E., who is a teacher at Crane Tech. High School, has recently moved to 3422 No. Linder Avenue, Chicago.

FISHER, FRANK JEROME, C.E., who is a cameraman with The Chas. Mintz Studio, is now residing at 914 N. Reese, Burbank, Calif.

HURLEY, JOHN WILLIAM, C.E., has recently moved to 3600—38th St., South, Seattle, Washington.

KOVARIK, JEROME H., M.E., has recently changed his address to 8919 S. Justine, Chicago.

KUPPERMAN, SAMUEL PHILIP, Arch., who is a Salesman for Modern American Builders, is now residing at 4834 Sawyer, Chicago.

PAUL, DONALD JOSEPH, F.P.E., has recently moved to 16220 Ward Avenue, Detroit, Michigan.

ROHRER, JOHN A., M.E., who is a Salesman for the Monroe Calculating Machine Co., is now residing at 7554 Ethel Street, Richmond Hts., Mo.

ROSE, JAMES J., C.E., is now residing at Deluxe Camp, Las Animas, Colorado.

SMITH, DAVID T., F.P.E., who was a special representative in West Virginia for the Lumbermen's Mutual of Mansfield and the Inter-State Mutual Agency, has announced that he has now established his own insurance agency in Charlestown, West Virginia.

SOUTHWICK, CHARLES RUSSELL, E.E., who is Research Engineer with the U. S. Gypsum Co., has moved to 922 George, Chicago, Ill.

WELDON, BERNARD J., F.P.E., who is an Engineer and Underwriter for Dulaney, Johnston & Priest, is now residing at 550 S. Quentin, Wichita, Kansas.

WILLIAMS, ROBERT R., C.E., who is Junior Engineer, Bridge Dept., Illinois State Highway Dept., is now residing at 1728 S. Pasfield St., Springfield, Ill.

1931

BOOKER, LEROY W., F.P.E., who is Sales Secretary for the National Old Line Insurance Co., recently moved to 2601 N. Filmore, Little Rock, Arkansas.

CHERNEY, NICHOLAS B., M.E., who is Flow Engineer with the Republic Flow Meters Co., is now residing at 906 Oakdale Avenue, Chicago.

GRIESMAN, ALBERT H., F.P.E., is now residing at 2450 Clinton Ave., S., Minneapolis, Minn.

HOLT, HARMON. S., F.P.E., has recently moved to 722 Taylor, Topeka, Kansas.

KNOX, EDWIN H., F.P.E., was elected secretary of the Milwaukee-Armour Alumni Assoeiation at the recent annual election meeting held in Milwaukee. Knox is Special Agent for the Crum & Forster Group of Fire Insurance Companies.

LARKIN, MAXWELL C., F.P.E., who has been a survey engineer with the Travelers Fire and Charter Oak Fire Insurance Cos., was recently made Special Agent working out of Minneapolis for the same companies.

LENKE, AUGUST JULIAN, F.P.E., has recently changed his address to 6351 North Paulina St., Chicago.

MCLAUGHLIN, BERLYN GRAY, C.E., who is in the U. S. Engineers Office, has recently moved to 447 N. Michigan Avenue, Villa Park, Illinois.

PODLIPEC, FRANK, Ch.E., who is with the Barrett Company, is residing at 824 Edgewater Road, Ridgefield, N. J.

Steinert, Reynold, Ch.E., who is employed by Beck Koller & Co., is now residing at 601 Woodward Hgts. Blvd., Detroit, Michigan.

Wilde, Albert Frederick, F.P.E., has resigned his position with the Missouri Inspection Bureau and is now with the St. Louis production office of the Insurance Company of North America.

1932

Beattie, Richard Frank, M.E., who is a Safety Engineer for Hardware Mutual Casualty Co., has recently changed his address to 6147 N. Leader Avenue, Chicago.

Braun, Donald G., Arch., who is with Chicago Housing Authority at 208 S. LaSalle St., is now residing at 10407 Eberhart, Chicago.

Christianson, Burnell A., C.E., who is Senior Surveyor, WPA, Navy Pier, has recently moved to 1011 North Mason, Chicago.

Clucas, James M., M.E., advises that his home address is 3864 Bamberger Ave., St. Louis, Mo., and offers this additional information:

Gentlemen:

I just received the March issue, and decided it was high time that I write regarding my change in address. I now reside at the address as shown above, having moved from my former address of 5316 Pershing Ave., St. Louis, Mo.

I am still with the Pomona Pump Co., at their St. Louis plant, and in the interstate sales dept.

Might mention that in April of last year I married an Evanston, Ill., girl, so hence the change in address as mentioned above.—Yes, I've been at this new address since then, but have neglected to so advise until today. All the issues have either been forwarded to me, or sent direct to my business address of 4301 S. Spring Ave., St. Louis, Mo.

I certainly enjoy each issue of the Armour Engineer.

Very truly yours,
James M. Clucas.

Dickey, William, E.E., who is an Engineer and Salesman for Trindl Products, Ltd., has recently changed his address to 5516 Leland Avenue, Chicago.

Elman, Julius, Arch., who is an engineer in the Structural Dept., Universal Oil Prod. Co., has recently moved to 215 N. Ottawa St., Joliet, Ill.

Erickson, Carl A., C.E., who is a Junior Engineer with U.S. Engineer Office, is now residing at Waterview Apt. B., Portsmouth, Va.

Fagan, Morton, E.E., who is an engineer for the General Electric X-Ray Corp., is now residing at 5214 Woodlawn, Chicago.

Finnegan, Joseph Bernard, Jr., F.P.E., who is a special agent for Crum & Forster, Fletcher Trust Building, Indianapolis, Indiana, has recently moved to 4510 Marcy Lane, Apt. 39, Indianapolis, Ind.

Jens, Charles Joseph, F.P.E., has been transferred to Milwaukee by the Great American Insurance Cos. to cover eastern Wisconsin in the capacity of Special Agent. His Milwaukee address is Astor Hotel. Office, Underwriters' Exchange Building.

Lind, Stanley M., Ch.E., is the proud father of a baby girl born April 22, 1940.

Scanlan, Emmett A., F.P.E., is Vice President of the Reserve Mutual Casualty Co. of Kansas City and may be reached at 2611 Fidelity Building, Kansas City, Mo.

Venema, Maynard P., Ch.E., is the proud father of Maynard, Junior, who was born in Chicago on April 13, 1940.

1933

Clanton, Carl Nolen, F.P.E., who is an Inspector for the Kansas Inspection Bureau, has recently moved to 1438 Byron Street, Topeka, Kansas.

Dubsky, Frank A., Arch., who is a Draftsman for Freyn Engineering Co., has recently moved to 5508 S. Honore Street, Chicago, Illinois.

Jenson, Gust, Jr., Ch.E., who is a Safety Engineer with American Mutual Liability Insurance Co., has recently changed his address to 411 Wendover Ave., Louisville, Ky.

Krizan, Leonard W., Ch.E., has recently moved to 5300 West Monroe, Chicago.

Larson, Bradford, F.P.E., has resigned his position with the Allstate Insurance Cos. in Chicago to join the engineering staff of the insurance firm of Boit, Dalton and Church in Boston, Mass. Rumor has it that a certain Kansas City girl will join Brad in Boston shortly and make him a Benedict.

Sneiling, Elroy Albert, E.E., who is Radio Engineer for the Zenith Radio Corp., has changed his address to 9935 Winston Avenue, Chicago.

Winogrond, Milton J., Ch.E., who is Assistant Metallurgist, Carnegie Illinois Steel Co., has moved to 6940 Clyde Avenue, Chicago.

1934

Bacci, Joseph Albert, C.E., who was with the Austin Co. in Chicago, is now in the Municipal Engineer's office, Balboa Heights, C.Z. He may be reached in care of General Delivery, Balboa Heights, C.Z.

Callen, Loy A., C.E., who is a Civil Engineer with the Sanitary District of Chicago, is now residing at 5245 W. Hirsch Street, Chicago.

Freitag, William C., F.P.E., who is an Engineer for the Fire Underwriters' Insp. Bureau, is now residing at 5135-36 Ave. So., Minneapolis, Minnesota.

Gerhardt, Herman, Arch., is now employed by the Acme Copy Corp., 53 West Jackson Blvd.

Henoch, Mark L., E.E., who is Purchasing Agent for W. M. Welch Mfg. Co., is now residing at 6849 East End Avenue, Chicago.

Kuffel, Charles P., F.P.E., who is an Engineer for Fred S. James & Co., is now residing at 1618 N. Keating Ave., Chicago.

Spangler, Charles D., C.E., is now residing at 22 High Street, New Haven, Conn.

1935

Bisbee, Hugh A., E.E., who is Motor Inspector for the Youngstown Sheet & Tube Company, is now residing at 2373 E. 70th Street, Chicago.

Citro, John, Ch.E., is with the South Chicago Coal and Dock Co. and resides at 3543 W. Jackson, Chicago.

Dalton, Robert Francis, Ch.E., writes this interesting letter to the Alumni Editor and informs us that he now resides at 72 W. Perrin Ave., Springfield, Ohio.

Dear Mr. Jens:

I received a copy of the Armour Engineer (March, 1940) and needless to say, it was a most welcome and interesting surprise. To bring my record up to date, I would like to add the following:

Following graduation, I went to work as a laborer at W. A. Jones Foundry and Machine Co. This was back-breaking work at thirty-five cents an hour, but I really enjoyed starting at the bottom. Since then I worked for various foundries throughout the Chicago area, finally getting a traveling job (demonstrator) with the Beardsley-Piper Co., manufacturers of the Sandslinger and Speedmullor.

Last June (1939) the former Miss Jeane Price, a well known singer from the Austin District, changed her name to Mrs. Robert Dalton. We traveled together for a few months and decided that a permanent home would be more desirable. I am now employed as Sandurgist at the Ohio Steel Foundry here in Springfield.

We make miscellaneous railroad castings, steel rolls, oil refinery fittings and corrosion and heat resistant (Fahrite) castings.

I would like to know the whereabouts of John Citro, Bob Lyford and Ed. Thompson and any Armour graduates in the South-Western district of Ohio. (Ed. Note: See 1935 Class Notes.)

Please give my best regards to Professor McCormack, Schommer, et al.

With best regards,

Sincerely yours,
Robert Dalton.

Kasmer, Chester Michael, E.E., who is Junior Electrical Engineer, Federal Power Commission, has recently moved to 6427 So. Knox, Chicago.

Levin, Henry, Ch.E., who is a Chemist for the Republic Steel Corp., is now residing at 3901 Arthington Street, Chicago.

Lyford, Robert George, Ch.E., is Sales Engineer with the Powers Regulator Co., 1634 Allen Building, Dallas, Texas.

Olson, Harold, C.E., who is a Project Engineer with the W.P.A., Chicago Municipal Airport, is now residing at 1950 N. Spaulding Ave., Chicago.

Thompson, George Edward, Ch.E., is with D. W. Haering & Co., 3408 W. Monroe St., Chicago.

Trudell, William Ambrose, F.P.E., has resigned his position as Engineer with the Insurance Company of North America to join the Engineering Department of the Fireman's Fund in Chicago. His address is 175 West Jackson Blvd.

1936

Cooper, Norman J., E.E., who is a Junior Field Engineer for Stewart-Warner Corp., has recently moved to 4617 Damen Avenue, Chicago.

Graupner, William Bernard, E.E., who is with the Bell Laboratories, has recently moved to 463 West Street, New York City, N. Y.

Greenman, Hugh Merrill, M.E., who is a Time Clerk for Woodward Governor Co., is now residing at 516 West State, Rockford, Illinois.

Kercher, Roy S., Eng.Sc., recently left his position as Production Engineer with Cutler Hammer, Inc., in Milwaukee to join the engineering staff of Underwriters' Laboratories in Chicago. His home address is 23 W. Franklin Ave., Naperville, Illinois.

Smith, Frederick Arthur, C.E., who is a Draftsman with the Chicago Park District, has recently changed his address to Burnham Park, Chicago.

Staudt, Henry P., C.E., who is Industrial Engineer with Wilson Packing Co., has changed his address to 4832 Bernard Avenue.

1937

Amory, George M., F.P.E., who is an inspector for the Iowa Insurance Service Bureau, has recently moved to 1811 Summit, Sioux City, Iowa.

Beckman, Morris H., Arch., who is an Architectural Designer for James Crabb, is now residing at 6130 N. Paulina Street, Chicago.

Carlson, Walter Emil, M.E., who is an aviation cadet with the U.S. Navy, re-

cently changed his address to 11001 Normal Ave., Chicago.

CARROLL, KENNETH FREDERIC, M.E., has recently changed his address to 23 Knowlton Avenue, Kenmore, New York.

CLARKE, ROBERT ALFRED, Ch.E., recently moved to Pennsville, New Jersey.

HEINZ, EDWARD N., JR., Ch.E., who is Chemical Engineer for Food Material Corp., has recently changed his address to 424 Iowa Street, Oak Park, Ill.

KICHAVEN, JOSEPH, Arch., who is a Draftsman in the U.S. Engineers Office, is now residing at 3048 West Leland Avenue, Chicago.

KREISEL, EARL F., F.P.E., who is an Engineer for Viking Automatic Sprinkler Co., is now residing at 5267 N. LaCrosse Avenue, Chicago.

NEARING, WILLARD, M.E., is now residing at 939 Harvard Bldg., Dayton, O.

SKACH, FRANK JOSEPH, M.E., who is Draftsman for Beech Aircraft Corp., has recently moved to 157 N. Ruban, Wichita, Kansas.

TARADASH, SAMUEL, C.E., is now residing at 14433 Wentworth Avenue, Chicago.

1938

ANDERSON, JOHN W., E.E., is the proud father of Glenn Lyle Anderson, who was born at the Chicago Memorial Hospital on Feb. 18, 1940.

CLOSE, RALPH GUY II, M.E., who is with the Globe Refining Co. is now residing at Lemont Illinois.

DANEK, JERRY, Ch.E., is now residing at 2723 Kenilworth Avenue, Berwyn.

McINTYRE, JOHN FORNEY, F.P.E., who is an Engineer for Federal Hardware & Implement Mutuals, may be reached care of General Delivery, Brookfield, Missouri.

PETERSON, RICHARD GEORGE, M.E., has recently changed his address to 8421 Oglesby Ave., Chicago.

POSKONKA, LEO BLAISE, Ch.E., who is a Chemist for Victor Chemical Works, is now residing at 7955 Emerald Avenue, Chicago.

RUNE, ADOLPH, M.E., is now residing at 951 South Western, Los Angeles, Calif.

1939

HOFFMAN, PAUL M., F.P.E., succumbed after a desperate fight against a kidney infection early in March. Paul had been with the Fire Insurance Rating Bureau in Milwaukee since his graduation from Armour last June. He had made an excellent record in the few months he was with the Bureau. He is survived by his parents and his sister.

HUBOI, CARL F., Arch., has recently changed his address to c/o W. Huggins, R.F.D. No. 1, Elmhurst, Illinois.

WATER SUPPLY

(From page 10)

hours daily, with three gallons being a maximum winter rate and four gallons a maximum summer rate. On account of the high friction loss through the sand beds at or above the four-gallon rate, this rate should not be exceeded nor should an attempt be made to maintain it continuously throughout the day. Should a coagulant only be used the maximum winter rate should average not more than two gallons for the day and should not exceed two and one-half gallons at any time.

The time of coagulating after addition of the coagulant to the water will be 58 minutes for a 280 M. G. D. yearly average of water treated. This will give forty-five minutes mixing time for the average of the maximum summer day of 360 M.G.D. and about thirty-five minutes for the peak hour demand of 460 M.G.D. The time of settling will be four hours for the yearly average of water treated; this time will be reduced to two and one-half hours at the peak rate.

Water Flow Through Plant

Raw water from the Edward F. Dunne Crib passing through the Filtration Plant Intake Tunnel, enters an intake basin at the East end of the Plant, several feet below Lake level, by gravity, and is screened before entering a suction well at the low-lift pump.

Four 50 M. G. D. and four 100 M. G. D. direct-connected, electric motor-driven, centrifugal pumps are provided to care for a peak load of 459 M. G. D. Various combinations of these pumps will care for widely fluctuating hourly loads and provide spare units to guarantee uninterrupted plant operations. The flow from each pump is recorded by a Venturi meter.

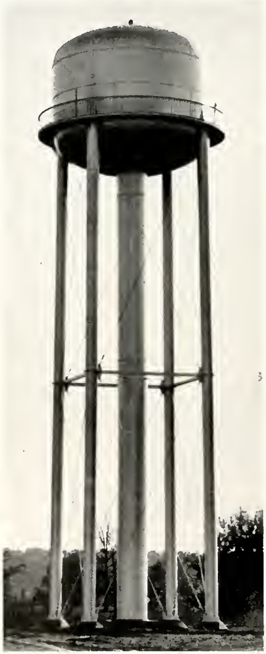
Each low-lift pump raises the raw water from lake level to an elevation of twenty feet above, in a double-decked raw-water conduit. This double-decked design of the raw-water conduit permits of either or both levels being used and permits of cleaning this conduit without interruption of plant operation. From the raw-water conduit, the raw water is metered to each of the three mixing, coagulating, and settling basins. Any one of the three units may be taken out of service for cleaning or repairs. Two will provide the average daily maximum requirements.

The settling basins are thirty-three feet deep but have an intermediate settling floor at one-half their depth. Over these intermediate floors, as well as over the floors at the bottom of the basins, sludge scrapers are provided to drag the sediment formed to one side of each basin where cross collectors convey the sludge to sumps where sludge connections provide continuous sludge removal.

This sludge runs by gravity to a sludge well and concentration tank where, after concentration, the water is laundered off and returned to the raw-water intake, while the sludge itself is removed for further concentration and disposal. Thus the treated water and its chemicals are reclaimed.

All filter wash water is returned by gravity to a sump, from whence it is pumped to the wash-water settling basins, where the sludge is settled out and the clear water is decanted over into the low-lift pump suction well. The sludge is added to that collected from the settling basin for further concentration and disposal.

At the end of each settling basin a recarbonation chamber is provided where carbon dioxide may be added. The treated water then passes through sluice gates into a settled-water header in the Filter Building. Four settled-



ELEVATED WATER TANK OF STREAMLINE DESIGN

A definite trend toward the streamlining of elevated water tanks in municipal waterworks systems has taken place during the past few years. This 75,000-gal. installation at Parchment, Mich. is a typical example. It is a Horton tank with a special ellipsoidal roof and tubular columns. The height to bottom is 75 ft.

water laterals branch off this header and, extending under the filter gallery floors, distribute to four units of twenty filters each. Each unit of twenty filters discharges into a separate clear-water reservoir located below the filters. From this point the filtered water passes into a clear-water header which discharges into the main clear-water reservoir, which is so arranged and divided by sluice gates that either half or all of the reservoir may be used. From the reservoir the filtered water enters the outlet shaft and thence passes to the underground tunnels which supply the pumping stations.

South District Filtration Plant should be delivering filtered water to the South Side of Chicago some time during the year 1943.

RESEARCH

(From page 14)

research should find application in many plants throughout the country.

In the sanitary laboratory of Armour Institute research is in progress on the rate of oxygen absorption in activated-sludge aeration tanks. Various aeration methods are being tested and the efficiency of each determined. A large model aeration tank has been constructed and is illustrated in the accompanying photograph.

The treatment of industrial wastes is closely related to the treatment of domestic sewage. In large cities the two types of wastes are mixed in the sewers and treated together in the municipal plant, while smaller cities require complete treatment by the industries in separate plants. In many cases the wastes are so strong that they must be partially treated before entering the sewers. In view of the many types of industries in Chicago, more research in waste treatment has been conducted by the Sanitary District than by any other similar organization. The results of this research are being made available to the graduate students at Armour Institute in the waste-treatment course conducted by Dr. Mohlman. Research is being conducted in the sanitary laboratory at Armour on the treatment of several types of industrial wastes by high-rate trickling filters. These units have been developed within the last decade as a result of the cooperative research of a number of chemists, bacteriologists and engineers into the fundamental factors governing filter performance. Higher loadings and greater removals of organic matter are obtained in the application of the principles discovered by these men. Applied research is still in progress. At Armour Institute model filters have been set up in lucite tubes where the behavior of the filter may be closely controlled and observed. The results of this research should serve to indicate possible extensions of the use of these filters to the treatment of industrial wastes which have heretofore been considered difficult to treat economically.

The sanitary laboratory at Armour Institute is well equipped to perform all standard analyses for the control and operation of water and sewage treatment plants. Bacteriological and chemical equipment is available for research in the treatment of water, sewage, and industrial wastes. Co-operation with chemical and equipment manufacturers has been excellent and has served to encourage research. Chemicals, feeders, pumps, meters, porous plates, and plumbing supplies have been contributed as a result of the policy of close cooperation with industry in practice at Armour. This year the laboratory is being expanded to cover several rooms on the third floor of Chapin Hall giving four floors devoted to sanitary work. Private research laboratories are being equipped for the research projects of the faculty and graduate students. The laboratory facilities are constantly being increased to broaden the scope of the research work in sanitary engineering.

NAVAL STORES

(From page 19)

4. Design of the building enclosure or weather protection to house the layout chosen.

5. Piping layout, schematic or actual, which indicates pipe-sizes and materials, valves, gauges, thermometers, flow meters, sight glasses, reducing valves, relief valves, liquid level gauges and steam traps.

6. Design of the facilities required in the process i.e., water, steam, electricity and sewers.

With the flow diagram fixed, the layout chosen will be an attempt to so place the equipment that the minimum number of operators will be required after due regard for probable and possible future expansion. This choice is, of course, further affected by investment requirement to achieve this "least labor" layout.

Vessels, from a design standpoint, fall in two classes, i.e., "pressure" and "non-pressure." "Pressure" vessels may be defined as those subject to either positive or negative pressure, which pressure may be generated in the vessel by steam or outside the vessel by pumps. "Non-pressure" vessels are primarily those used for storage, gravity separation, agitation or vapor scrubbers. The "non-pressure" class are usually "garden variety" welded steel tanks built to our own requirements without consideration of any of the Codes. Nozzle flanges are of steel, welding where possible is double-Vee butt, heads are dished only (not flanged) to avoid cracking of the heads due to flexing, and frequently the dish radius is greater than the tank diameter.

Vessels falling in the pressure group are designed in accordance with either the A.S.M.E. Code for Unfired Pressure Vessels (Par. U69) or the slightly more liberal A.P.I.-A.S.M.E. Code. In certain cases it is our practice to require complete-anneal of the vessel because of corrosion considerations, though this is not required by the Codes. We do not allow local stress-relieving of any of our vessels. Of great importance to us are flanges, either of sufficient thickness or sufficiently hubbed to permit the making of joints which are free of leaks under naphtha at considerable temperature and pressure. Frequently tanks must not only permit the application of pressure, but must be agitated as well, which requires fitting of agitator drive-units and suitable stuffing boxes.

The specifications for pumps require careful consideration. Piston-type pumps are extensively employed; they are equipped with plate-valves for mobile fluids and ball valves for viscous materials, especially when handling them under vacuum conditions. Many of these pumps are operated on boiler-pressure-steam exhausting to the twenty-pound system; this arrangement, when steam-balance permits, results in a very low pumping cost. Centrifugal pumps are generally used to handle non-viscous fluids, either with closed or open impellers. Rotary pumps of bucket or gear type are employed for the more viscous liquids which lend themselves well to steam jacketing.

Of interest for high temperature application is the use of Dowtherm, a mixture of diphenyl-diphenyl oxide, used in its vapor phase to achieve high temperature at low pressure. These Dowtherm vapor generators are in effect small tubular boilers, oil or gas-fired, which employ Dowtherm in place of water. Our applications have all been of the straight vapor-phase type with gravity return to the boiler. They provide a convenient and effective way to use high temperatures but at the outset presented some problems due to leakage at joints and even traces of water in the systems. The leakage problem was solved by using Series 30 flanges, high-strength bolts and profiled steel gaskets. The difficulties occasioned by even very small amounts of water were solved by the application of heat and vacuum which also removed the non-condensibles.

With large quantities of solvents being handled, of necessity, much thought has been given to fire hazards and fire protection. Recognition of hazardous conditions has resulted in the venting of all tanks through water-tower scrubbers, and where this is not possible through flame-arrester vents. Deluge and sprinkler systems are extensively employed, backed up with large water supplies. Brick fire walls have been placed at strategic points. There is much car switching to be done in the yards in proximity to the buildings and fat stump-wood stocks and to eliminate spark hazards a fireless steam locomotive is used, securing its steam supply from the plant boilers three or four times a day. Motors and their wiring in hazardous locations are of Class 1, Group D, National Electric Code and elsewhere of totally enclosed fan-cooled type in rigid conduit.

DEAL WITH OUR ADVERTISERS

(From page 23)

disfavor and those charged with ultimate responsibility have shown an increased tendency to draft the engineer for major administrative work. This use of engineers has produced some of the best administrators of the last few years.

An interesting item in this catalog of recruitment from the ranks of engineers is that, of 466 city and county managers in the United States, forty-six percent are engineers.

Nevertheless, one of the great unanswered questions in the field of public employment today is—will the engineers live up to the possibilities of the situation?

You may wonder why there should be any such question, more than would be associated with recruitment in the ranks of any other profession. If so, I must in candor say to you that the question arises from the experience of those men in public life who too often have found the engineer expert in the handling of material problems and inept in the handling of those problems which involve, not the manipulation of material things, but the handling of persons and situations which were essentially intangible. Stated negatively, our contemporary engineers in the opinion of many reveal their greatest weakness when assigned to general administrative responsibility in their inability to adjust their thinking to social or economic objectives which in a given situation may be of paramount importance.

Engineers often incline to know too little about government operation in its largest aspects, about the social and economic objectives of government; indeed, too little concerning the statutory controls effective with respect to the very operations they are attempting to superintend. The man who heads large public enterprises ought to have at least a rudimentary understanding of law, finance purchasing, and other fundamentals of general administration. If in the government service you want to be just an engineer and make yourself thoroughly ineligible for those major opportunities which are today opening so largely to the engineers, just be exclusively an engineer; scrupulously avoid training in those subjects outside engineering which are essential to efficient performance as a general administrator.

It is my understanding that your splendid faculty as well as the faculties of other engineering institutions have given much thought to this problem, and it is my hope that they may be supplied with whatever it is they

need to make available to you courses which once perhaps were regarded as irrelevant to engineering, but which, in the turn of events may have become very important to you and the communities you are destined to serve.

I would not like to leave you without saying one more thing which comes from close to my heart. We have, in these few minutes, discussed the field of public service largely from the viewpoint of your own opportunity and success. There is another viewpoint which bids me ask that whosoever amongst you is efficient and whosoever amongst you honest, consider seriously the opportunities in public service. You and I and all of us are partners in a common enterprise—government. We are perhaps too little conscious of the benefits which all of us enjoy under the political institutions of free men. These institutions do not carry on of their own momentum. Political forces—and here I refer not to parties, but to political philosophies of a broad, fundamental sort—are driving about in the world with such momentum that only those political systems can be stable and enduring which can justify their existence with a record of efficient performance.

If we are to continue to enjoy the institutions of freedom, institutions which assure to us individual liberty and opportunity to the greatest extent that institutions have ever assured these benefis to men, our governments—federal, state, county, and municipal *must be efficient*. This then can be only as they bring into their service men of the highest technical and personal qualifications.

TECHNOLOGY

(From page 24)

Certainly, the record of Armour's civil engineers of '06 suggests that President Heald, himself a young civil engineer, was well informed when he spoke of achievements of engineering graduates in public service.

The chances of an engineering graduate becoming head of an industry are "many times" the chances of graduates of other types of colleges, Heald stated. He cited a recent survey made by Robert H. Spahr of General Motors Institute, which shows that, of the 235 college trained presidents of leading American industries, 151 were trained in engineering colleges, and only 84 in colleges of other types.

"Considering the relative number of graduates of both types of college, this indicates that the probability of an engineering trained man becoming an industrial president is ten or twenty times as great as the probability for a man of other type of college training. A survey of the graduates of Armour Institute of Technology indicates a corresponding trend. Out of some 3,400 alumni—and a rather young group at that, since the first class was graduated in 1897 and the early classes were small—112 are presidents of industrial corporations, 74 are vice-presidents, 175 are general managers, and 224 are chief engineers or superintendents."

It would be interesting indeed if Armour Institute would make a survey of engineers in government, on the order of the General Motors study of engineers in industry. Perhaps they are less "unsung and unrecognized" than Heald thinks.

The maze of problems involved in Chicago's tax delinquency, where lawyers rather than engineers are the leaders, suggests the need in government for straightline engineering thinking. Three or four groups are in the field with three or four plans for meeting the situation. The Chicago Bar Association is parent of the "Emergency Committee on Tax Delinquency." Lawyers are more circuitous, timid, and negative than engineers. When an engineer is busy finding out how to do something, a lawyer is busy finding out all the reasons, and precedents therefor, why it cannot be done. It may be unfair to suggest that engineers can, in the present tax mess, do much better than lawyers. But if there had been more participation of engineers with lawyers in the past, the present tangle might be less involved.

"The future of technological education in Chicago seems bright," Heald concluded. "I hope that in years to come engineers may occupy an even more important role in the determination of public policies, and in advancing the welfare of the citizens of our city and of mankind in general."

INDUSTRIAL RELATIONS

(From page 26)

to forced attention. There will be a "period of improvement with no practice." A learner may be encouraged by the use of a "learning curve." On a sheet of cross-section paper, the bottom may be laid off into hours, the left-hand margin into pieces per hour. If he makes six pieces the first hour, eight the second, ten the third, etc., he can see by the curve how he is succeeding in approaching the standard for full production.

Learned muscular responses become habits. You drive your automobile safely while talking to a friend. You buy a new model, and you cannot find the starter button. You have to be re-trained. You can be re-trained; you have both aptitude and ability.

Aptitude is what you possess by nature. Ability is what learning and practice can do with an aptitude. Every individual has a certain pattern of aptitudes; a machinist probably could have been trained as a carpenter, a pattern maker, a welder, a millwright, a draftsman, a plumber, a dentist, or a structural iron worker. Once trained, the emotional adjustment to re-training in one of the other occupations might not be so easily accomplished. There is a social status with each kind of job which causes resistance to change to a lower one.

Most everyone knows something of his abilities but may be wholly unaware of his aptitudes. One of the general aptitudes about which we are concerned is intelligence. Aptitudes are said to increase from birth to around fourteen to sixteen; however, a genius will show his characteristics at from six to ten years, as will also the imbecile and moron. Intelligence is the native capacity to learn. Education is the result of learning, not an increase in intelligence. We are vitally interested in placing the right man in the right job, but no organization ever succeeds in placing every man where he will be most effective. Compromises must sometimes be made, and misfits tolerated.

Applied psychology can do much to correct these situations. A large manufacturing company in Rockford has a trained psychologist as an employment manager, who passes upon the qualifications of shop, office, and executive alike. The General Manager told me it was uncanny the way he could predict results before an employee was hired. There are no tailor-made tests which may be used for all kinds of jobs in Industry.

The Illinois State Employment Service can supply you with office help

chosen on the basis of tests that have been well standardized, or can give tests to your prospects and predict performance; but considering any industry as a whole—tests are not that far along. The Philadelphia Electric Company, the Western Electric Company, Procter and Gamble, and a few others are using Industrial Psychologists and are getting good results.

In conclusion let us re-examine some of the points covered.

1. Men are subject to emotional behavior patterns, which make their work a pleasure or a drudgery; make them contented or discontented.

2. Emotional behavior may or may not be recognizable.

3. Emotional behavior can be improved.

4. Successful performance is a result of learned behavior.

5. Learned behavior or habits cannot always be quickly applied to a new job.

6. Ability to learn is dependent upon an aptitude for the particular kind of work.

7. Intelligence tests, aptitude tests, vocational interest tests, visualization tests, and personality tests have been applied in high school and college situations but have been applied to Industry with caution.

BOOK SHELF

(From page 32)

likely to be literary and aesthetic, the latter to be strictly practical.

Professor McColley in choosing his materials for *Literature and Science*, has wisely freed himself from the conventions of literary English departments, and has produced a book admirably suited to the needs of scientific students. Of the fifty or more authors he has included, about half are unfamiliar to the average student of English literature, and even the familiar names are represented by unfamiliar selections. The reports of early scientific writers, from the seventeenth century on, as well as essays in which our scientific progenitors meditated on their own methods and their implications, cannot but give the student a respect for the step by step cooperative accumulation of data by which science has arrived at its present organization and usefulness. Selections from Robert Boyle, from Sir Thomas Blount, from Henry Power on microscopical observations of the louse, from Benjamin Franklin on mammoth tusks, from Henry Baker on the "chain of being" (the precursor to the theory of evolution), give the reader a very real sense of the continuity of scientific endeavor, and of the position of the modern investigator, no matter what his field, in the long and honorable roll of scientific workmen.

No less useful are the selections that give us the public attitudes towards science, represented by parts of Swift's "Voyage to Laputa and Balnibarbi," by Thomas Shadwell's *The Virtuoso*, by the essays on scientific subjects by Addison and Goldsmith. The ridicule that scientists had to put up with, both merited and unmerited, is something that we are too likely to forget, accustomed as we are nowadays to the placid public acceptance of every kind of improbability from the photoelectric eye to dress fabrics made of glass.

Those selections which give us the philosophical reactions to science will be most interesting to the thoughtful reader. We tend to forget, unless reminded by such a collection as this, how far Bacon, Locke, and Hume had carried their empirical outlook, and how much of what they said could still be written in large letters around the walls of any modern scientist's laboratory as reminders of the principles they should be practicing. The selections from the nineteenth century will perhaps be most useful to the student. The struggles of Tennyson against the imagined "materialism" of science; the eloquent defenses put up by Lyell, Darwin and Oliver Wendell Holmes; the mediatory position of Matthew Arnold in his *Literature and Science*—all of these will help the student to see his technological preoccupations against a wider background, and enable him better to reconcile his conflicting scientific and non-technical interests into a cohesive philosophy.

S. I. HAYAKAWA.

HELP! HELP! HELP!

(From page 33)

Industrial engineers. Minimum age thirty-two. Local steel company. $250 to $500 per month.

E. E. with experience in locks, combinations and signals. Excellent position. Life-time job.

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JOHN J. SCHOMMER,
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THE ARMOUR TECH RELAYS

By

ALEXANDER SCHREIBER

We asked our favorite publicity man to take down his hair and write this story without inhibitions in the matter of style and content. He was obviously happy at the absence of editorial restraint.—*Editor.*

It has been suggested to us that the ARMOUR ENGINEER and ALUMNUS should contain in the May, 1940 issue a story about the running of the Twelfth Annual Armour Tech Relay Games. Naturally, being boosters of what we consider the midwest's most outstanding climax to the indoor track and field season, we heartily agreed with the editor-in-chief, whose suggestion let us in for a considerable amount of hard work, regardless of how thoroughly we approved of his idea. However, we now prepare to do a story of those now famous few hours during which a darkhorse college from Michigan, and a brilliant miler from Wisconsin, and a sprinter from Nebraska thrilled a record-breaking crowd of three thousand Chicagoans into yelling themselves hoarse.

Yet this story—a report of the happenings in the University of Chicago field-house during the afternoon and evening of Saturday, March 16, 1940—should be more than just a recounting of the schedule of events, the times and distances established, the records broken, and the medals awarded. It should contain some of the spirit and life induced in the assembled onlookers, the hopes and ideals of the contestants, and the feelings of the coaches and judges whose services helped to make world champions and whose critical eyes and efficient and deadly stop-watches and tapes shattered or established the hopes of the contestants. We can think of no other method of making this report (and we hope that this method will be satisfactory) than to recount our own experiences from the wakening moment of that memorable Saturday, March 16 1940, until the last word had been filed from the top of the East stands where press row was located. So, throwing all caution to the winds, with the thought of reporting all that we sensed and saw from our precarious seat in press row, we write our story.

Although our chief responsibility during our five years of experience with the Armour Tech Relay Games has been that of providing a combination of messenger service and information bureau for the sports press, we had the pleasure of working with John J. Schommer and Norman Root in the planning of individual events, preparation of the program, checking of medals and cups, and the host of other details that comprise a well-run meet. It was our intention, as in previous years, with the help of our efficient student organization, to spend our time "trouble-shooting" during the running of events and leave the really hard work, the consistent minute-after-minute collecting of results and reporting to pressmen, the chasing after contestants for full names, and the reporting of last minute changes, in the hands of the student assistants. With the day so planned, we collected all of the necessary forms, sheets, contestant numbers, medals, finish-line-yarn and ourselves, and proceeded to the University of Chicago field house. We checked the seating arrangement in the press row, we saw to it that the finish judges had sufficient information and record cards, and then we prepared to rest for a few minutes until the really tough job of trouble-shooting should begin with the start of the final events at seven o'clock in the evening. This was at four o'clock in the afternoon. We planned to proceed to the Del Prado Hotel to partake of a delicious dinner which was the only reward heaped upon the forty-odd judges for their long hours of service in behalf of the five-hundred relay competitors.

However, our joy in helping to plan another successful meet was curtailed, and with it went the delicious steak and the affable companionship we expected to enjoy in the company of the officials at the hotel. For, with a speed and a crackling that was ominous, there came a clicking and a returning clacking over one of the many Postal (or maybe it was Western Union) directly connected newspaper wires, to the effect that the *Chicago Tribune* was extremely shorthanded in their sports department that particular afternoon and evening, and would Mr. Schreiber be kind enough to send the results to the "World's Greatest Newspaper" just this once in return for the many favors the employees of the "Colonel" had bestowed upon the press relations department of Armour Institute of Technology. The clacking referred to above was the "yes" in answer to the question. We were still, and we might truthfully add, are still thinking of the luscious steak we missed. But, all kidding aside, we learned something that afternoon and evening and we are thankful for having had the experience.

Swearing under our breath, we seated ourselves next to a twitting Postal Telegraph operator, with one from Western Union to our right, prepared to do our best for the "man in the slot" ten miles northward in the Tribune Tower. The Western Union operator with the telegraph key to our right was always insisting that we give him carbon copies of our material so that he could keep Associated Press informed of the results of the preliminary events while a Postal operator was also using our material to keep the *Herald-American* informed. Our state of mind was poisonous. It was not entirely normal until the finish of the last event seven hours later.

By the time the preliminary events had been concluded and we had filed our last report of the afternoon to the cavernous mouth of the multiple presses of the *Chicago Tribune,* we were wringing wet; the press row was located about two stories higher than the U. of C. field-house track and we did not have a runner to bring us the results—so we had to chase up and down two stories of bleachers every time we wanted results of about a double baker's-dozen of preliminary events. But with the coming of the final events, our chastisement really began, and so did our education.

After partaking of a pint of milk (shared with a student assistant) and a cheese sandwich and watching Norman Root, Tech track coach balancing a malted milk and a ham sandwich in his left hand and making entries with his right for the various and sundry final events which were to begin some fifteen minutes later, we felt as though we were prepared to continue our unorthodox combination "trouble shooting" and reporting job. It couldn't be done. Filing results was a full-time job in itself. So, complacently leaving the Relays to take care of themselves, we sat down to absorb a few minutes rest—to no avail.

The first pressman to arrive was Bob Jaffee of the *Chicago Herald-American* who sidled up to luckless Mr. Schreiber and began berating us for having given the Chicago Hearst paper a bum steer. We had said that Elmer Hackney of Kansas, shot-put

wonder of 1939, who failed by a few paltry inches to establish a new world's record in the weight event, suffering from a broken wrist, had shifted to putting the shot with his left hand. He was working out with his right hand. (Incidentally, he won the shot-put event of the Games, although not with a record-breaking toss). So we spent a full five minutes playing the well-known army game, passing the buck first to the press agent from Kansas and then back to Hackney himself.

By this time, Earl Hilligan of Associated Press had arrived, and we entered into a discussion of the merits of the Armour Tech Relays, and even he, a veteran at the game of reporting sporting events for millions of track and field fans, had to admit that the Armour Tech Relay Games had something to offer that could not be found in any other of the indoor meets throughout the country. And pretty soon Steve Snider of United Press (perfectly comfortable in sports shirt and jacket—we wore tie, vest and coat) and a young lad from the *Chicago Times*, whose name we cannot recall, plopped themselves down on the thoroughly uncomfortable press-row bleachers, preparing themselves for "just another reporting job" (these news men certainly can impress one as having an especially jaded appetite for sports news). One comment we heard was, "Damn, I don't know a thing about track and field events, why do I have to get these assignments." The man who said that, incidentally, wrote the best story about the various events that we have read to date.

So, after having assisted the guard in placing the various press representatives in their proper seats, and insured ourselves of no interruption by telling all pressmen that there was a possibility that only one record would be broken, and listed for them the various case histories of particular athletes they were interested in, we ourselves settled into our own spot way off to one side, threaded a sheet of Postal press paper into a 1927 portable Remington (and how we swore during the high heat of turning out a bulletin reporting a new world's record when the spacer continually insisted on sticking) and resigned ourselves to our job.

So, with lackluster eye we watched the preparations attendant to the lining-up of athletes for the college two-mile relay event, resigned to the fact that here was a race which did not bear watching; after all, you really have to have top-flight competition to set records in relay events and last year Michigan Normal had set a new record in this event that was plenty good. What is more, according to our own handicapping, there wasn't a team entered which had come anywhere near this mark during the 1940 indoor season. Well, we decided to keep a weather-eye peeled—fortunately—for, racing as the teams were against time, a Michigan Normal runner come pounding out of the starting blocks, round the first turn, digging in spikes with dirt flying in all directions. Still we were not much excited (the same can be said for all of press row—most of the men were engaged in desultory conversation). And then Paris, of the combination of Glidenstein, High, Lee and Paris of Michigan Normal, rounded the turn just below press row and began sprinting for the finish with another contestant at his heels. We still felt skeptical about the whole thing—only to have our hair stand straight up on our heads when Joe Lipp, official timer, through his announcer, G. N. Watrous, announced a new record-breaking time of 8 minutes, 6.5 seconds for the event—the impossible had happened! But still our enthusiasm was not fully aroused and that little bit of enthusiasm was killed with a relatively slow time for the following event, the college 70-yard dash.

The next event, however, set us all on edge again and added, so to speak, the knock-out punch while we were still staggering from that inflicted by the

record-breaking time in the college two-mile event. Gene Littler, a red-headed unknown from the University of Nebraska, whose running the week before during the Big Six indoor competition at Kansas City rated him as a possible winner in the university 70-yard dash, added that highly unexpected knock-out punch. With Walter Shelton of Marquette, favorite sprinter, at his heels, red-headed Gene Littler left the starting blocks as though he had been shot out of Doc Monilaw's gun. (Doc Monilaw is the veteran starter for the major portion of track and field events throughout the middle west), and led the favored negro from Marquette to the finish tape to tie the existing record for the 70-yard with a time of 7.1 seconds—equalling the record for this event established first by Johnson of Illinois Normal in 1933, and tied in following years by Herman of Carleton, Grieve of Illinois and Shelton of Marquette.

To add insult to injury, heaping more work upon a press row that had settled itself to a routine job of reporting, the university team entrants engaged in a death struggle in the next event to establish a new record in their two-mile-relay event. A favored University of Illinois combination, fresh from success the preceding week-end upon the same track during the Big Ten conference meet, came to an honorable defeat at the hands of the Marquette combination from Milwaukee. Close . . . close is not the word for that race for the lead shifted with practically each leg of the relay and only during the last lap, with Illinois leading and Marquette's Leonard Pruski running the anchor leg, was the race finally decided. As the contestants came pounding into the back-stretch turn, we can still recall the antics of Ted Carpenter, press-relations representative from Marquette who was doing double duty by filing a story of the Relays of the *Milwaukee Journal,* jumping up and down on the insecure press-row bleachers, endangering his own life and the life of his wire man, shouting encouragement to the Marquette man who broke the tape to establish a new record in this event with a time of 7 minutes, 52.4 seconds.

By now we were wide awake—for here, within the first fifteen minutes, unknowns in the hall of track fame had written their names on honorary plaques and demanded that they be hung with due respect and ceremony next to those of Lloyd Siebert of North Central who is still clearing the bar with record-breaking heights in the East; Al Haller of Wisconsin fame; Allan Tolmich of Wayne University, and the other notables. What would happen during the two hours of competition to come, especially since the featured event of the evening, the running of the special three-quarter-mile race for a world's record was still in the offing?

There was to take place, however, another incident which was to plague us; our capable assistant, veteran of several relays competition, had not yet arrived and we had been planning to depend upon him very greatly to hold up our share of the "trouble shooting" because of our special assignment for the "World's Greatest Newspaper." Then, with the sports representatives in press row shouting their heads off for first names of contestants, background color material about the record-breakers, and more definite information as to how come a small college could possibly turn out athletic material good enough to compete with the best that the Big Ten, the Big Six and the Central Intercollegiate Conference had to offer, in walked E. J., our truant assistant. When questioned as to the lateness of his arrival, he came back with a breezy retort that had something to do with tickets purchased many weeks before for a matinee showing of GONE WITH THE WIND—Lord, we had actually gone with the wind, what with records falling fast and furiously about our ears, and "trouble shooting" itself needing trouble shooting. Yet we settled down, unmindful of the vile cigar that was part and parcel of every Relays competition that E. J. attended.

And so the events intervening between the first fifteen minutes of hair-raising competition and the world's record in the three-quarter-mile run come to our attention. In rapid succession, we witnessed a group of youngsters from high school, the fountain from which springs the track and field record-breakers for Armour Tech Relay Games to come; the college and university high-hurdles wherein Michigan State Normal reasserted very strongly its bid for a college-division championship and wherein Joe Finch of Northwestern decisively beat the favorite Marquette timber-topper Robert Shurilla and the highly touted William Smutz of Nebraska; and the quarter-mile run.

But before we recount the thrilling race run by the favorite son of the Badgers, we must set down a word or two about *the* incident, in fact the only incident which made us leave press row to do a little "trouble shooting." We were just preparing to watch the exploits of junior-college stars in a special sprint-medley relay race, wherein another record was to be set, when Doc J. F. McNamara, physician of the Institute, standing by for accidents that might occur during the Games, laboriously climbed the two stories of bleachers to our precarious position in press row and advised us that a runner had given all he had stored up within him in an attempt to win the quarter-mile only to have a freak accident rob him of the glory that he might have had. We must necessarily advise those of our readers not quite familiar with track events, that the quarter-mile is by far the most grueling of all track events in that the athlete must give all he has from start to finish. In other words, from the very instant that the sharp bark of the starter's gun signals the start of the race, the athlete must sprint two laps of the track, a full quarter of a mile, at top speed until the tape is broken. James Mitchell, six feet of muscle and stamina, visibly a bundle of nerves, stretched to a fine line, was running a spectacular race in his heat of this event, only to stumble within ten yards of the finish tape and with him fell all the hopes he had of making a showing for the college he represented, for he was the only entry Ripon sent to the Games. Pain coursing through his body, and thinking only in terms of the college he had let down, Mitchell was carried to the locker-room. So great was the anguish of losing a race and so painful was the reaction of having given all the energy stored up in his body, that it was necessary to send him to a hospital where he could have the necessary care to relieve both the mental and physical ailment.

Looking at our schedule, by the time we had climbed back up to the press row, we remembered rather vaguely that the special three-quarter-mile run was scheduled for 8:55 o'clock (we still had an intensely warm feeling in our heart for the Ripon lad) and noted with considerable concern that the events were now all of three-quarters of an hour behind schedule. This gave us no end of worry and trouble; Earl Hilligan of Associated Press and Steve Snider of United had deadlines all over the United States to make; we did not stop to think of what the man in the slot, whose name was Howard Martin, at the *Tribune,* might have to say to us for failing to meet the many deadlines at Tribune Tower. We might also add that we kept quiet about the time situation when speaking to Bob Jaffee of the *American,* a particularly hard job since he was sitting right next to us. But much to our surprise none of press row seemed to care much about the time, for all interest was centered in clearing through the wires the record-breaking results thus far obtained and servicing

advance color about the race which was to begin any moment.

And so we come to Charles "Chuck" Fenske, the miler of the year, the thin, machine-like runner from Wisconsin University, who had, up to the running of the Games, beaten King of the Milers, Glenn Cunningham, seven times during the 1940 indoor season, and who now was aiming for a world's record in the three-quarter-mile run. Fenske had elected to run against a time that had been established in 1925 by Lloyd Hahn in New York City; 3 minutes, 3.4 seconds—a record that had been broken but three days earlier by Fordham's famous negro middle-distance runner, Johnny Borican, with a time of 3 minutes, 1.2 seconds. So, Chuck's task was a much harder one for he had been planning to travel the route in approximately three minutes, 0.2 seconds. Now he really *would* have to exert himself.

Frankly, when the announcement was made that Chuck would have to run the route in about 3 minutes, general gloom fell over the assembled crowd. Naturally, you can appreciate our own disappointment, as we were depending heavily upon the publicity we could obtain for Armour Tech with a world's record to talk about. Press row especially was very doubtful as to whether this youngster, veteran though he was, could break this record. So with all eyes but our own riveted upon Doc Monilaw's upraised starting gun, we of press row nonchalantly leaned our tired backs against the stiff guard-rail and pessimistically predicted a nice but calm race for the spectators and began lighting cigarettes and paring our finger nails with an air of boredom. In order to keep ourselves posted in the event that the record was broken (this was all precautionary, you understand, and not necessary, in our estimation), we requested the press-row page to obtain the times for each lap.

Let me take time out here to wipe my brow, for even the memory of the ensuing two minutes makes me perspire profusely when considering the fact that we might have missed even a second of that thrilling race (think of the millions of readers one would have disappointed). Well, to get to the nub of the story, announcer G. N. Watrous, started us out of our lethargy by beating the press page to press row by means of the public address system with the result of the first lap—220 yards—one-sixth of the distance Fenske was scheduled to run—with the time of 29 seconds. How we wish at this point that we had the voice of a Graham McNamee so that we could fittingly announce in stentorian tones every incident that crowned that memorable race, or even better, the gifted pen of Grantland Rice to more fittingly describe with flowing terms that spectacle of life and color, of intimate contact with fame, and of tense moments that deserve the touch of heart-tearing fiction. Snap to attention we did—and with a flourish—for now we began composing those terse bulletins, "Fenske travels the first lap in 29 seconds," and flying bugs (the super-speed telegraph keys our wire operators used) were beginning to tell the story of a happening of vital importance to the sports world.

Questions began popping, "Could Fenske last the terrific pace" . . . "Who are the pacers" . . . "Lord, he isn't even breathing hard" . . . these could be heard as Fenske rounded the press turn at the East end of the track just before coming down the home stretch for the end of the second lap . . . and then a period of unearthly quiet, as the timers conferred upon the time for the second lap . . . 58.7 seconds . . . 58.7 seconds for the quarter-mile . . . he had traveled the second lap in approximately the same time that he traveled the first . . . if he kept this up he would finish the race in less than three minutes . . . all of this remember in the space of less than one minute . . . full of action, charged with anticipation, the crowd stood up and roared, and praise be to the powers that curb or set off the reactions of newspaper men, even they stood up and one by one began shouting encouragement to this little graduate student from the University of Wisconsin to continue that distance-consuming, time-stopping pace . . . finally, around the press curve and into the home stretch, both pacers back into the race again and lengthening their stride, spurring "Chuck" on, sprinting faster and faster in front of him and, with thirty yards to go, stepping off the track to let the bespectacled miler finish by himself . . . three-quarters of a mile . . . six grueling laps at a steady pace . . . and a burst of flash bulbs . . . a round of hand-shaking . . . and still no verdict, for the timers were busy arguing and comparing infinitely accurate stop-watches . . . finally, Watrous again, amidst that same unearthly quiet, began . . . THE RESULTS OF THE ARMOUR TECH RELAYS FEATURED RACE—THE SPECIAL THREE-QUARTER-MILE RUN BY CHARLES "CHUCK" FENSKE, (Lord, would he never get to the time). SIX LAPS IN THE TIME OF TWO O O O O O . . . and then did the crowd roar, for they, as well as we, knew that a new world's record had been established . . . Watrous had to start all over again and this time he managed to announce the complete time . . . 2 minutes, 59.7 seconds . . . completely surpassing the mark established by Lloyd Hahn, the unofficial time set by Johnny Borican during the same week, and also surpassing the outdoor mark set by the famous Wayne Rideout at Princeton in 1938.

There were several minor incidents which seem to stand out in our minds as we review the race . . . questions popped at us by press row . . . who were the pacers . . . we insisted they were Ed Buxton and Jerome Bauer of Wisconsin . . . actually, the pacers were Buxton and Howard Schoenicke . . . would the record be officially accepted . . . we said it would . . . doubt was expressed by officials because the race was paced . . . we insisted that this didn't matter, because Cunningham's fastest time for the one-mile run was a paced race . . . we learned later that Cunningham's time was not accepted.

By this time we were the proverbial nervous wreck, what with trying to answer the questions of press row and at the same time satisfy the man in the slot in Tribune Tower. We don't even remember seeing Jean arrive (although, somehow we gathered that she was there during the heat of the race, and that we did have a date that night). The rest of the evening was lost to memory in a maze of clacking and clicking telegraph keys and typewriters, shouted instructions to the wire man and demands for soda pop and hot dogs (seems to me that Jean was sent for refreshments and to add insult to injury, she was forced to pay for the "steak substitute" from her weekly earnings).

While wave after wave of track and field aspirants crossed the finish line to add more heat to a thoroughly sizzling set of press wires, to recount those events individually would be in the nature of anticlimax. We should like to say, however, that Michigan Normal (they were handicapped by us as not having a chance because of an entirely new team), winners of the college-division team title for the second successive year, proved to be the dark horse of the meet.

And so goes the story of the Armour Tech Relay Games—a man runs himself sick, another breaks an existing world record, a dark-horse combination wins a team title, and colleges and universities gain fame and have fun. The reactions we ourselves experience as recorded here are but a few of those we remember and we hope that they have served the double purpose of reporting a corking good meet and at the same time, cleared the air to a certain extent of the dogma surrounding press row.

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